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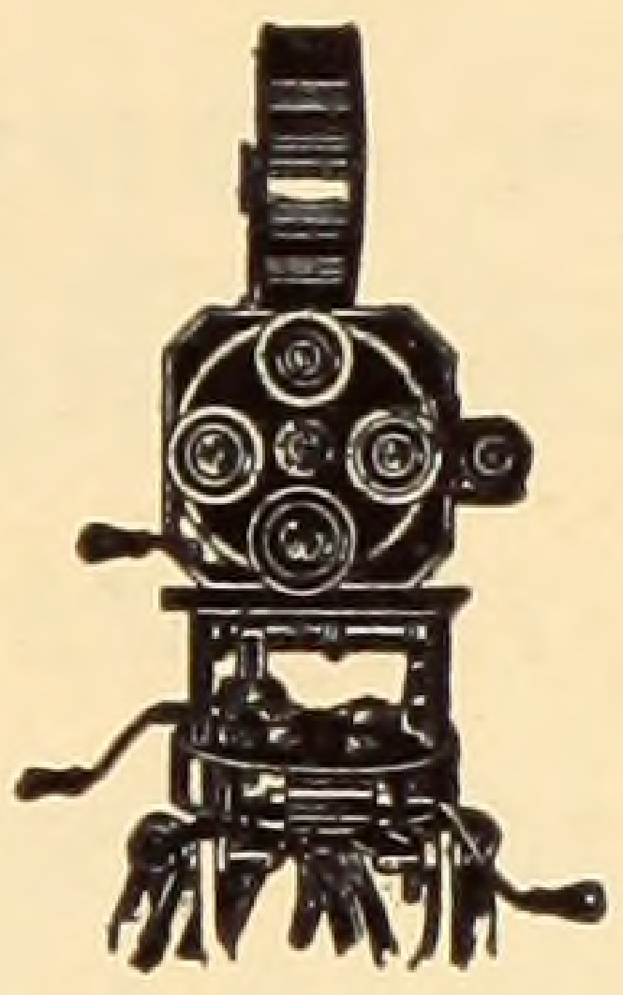

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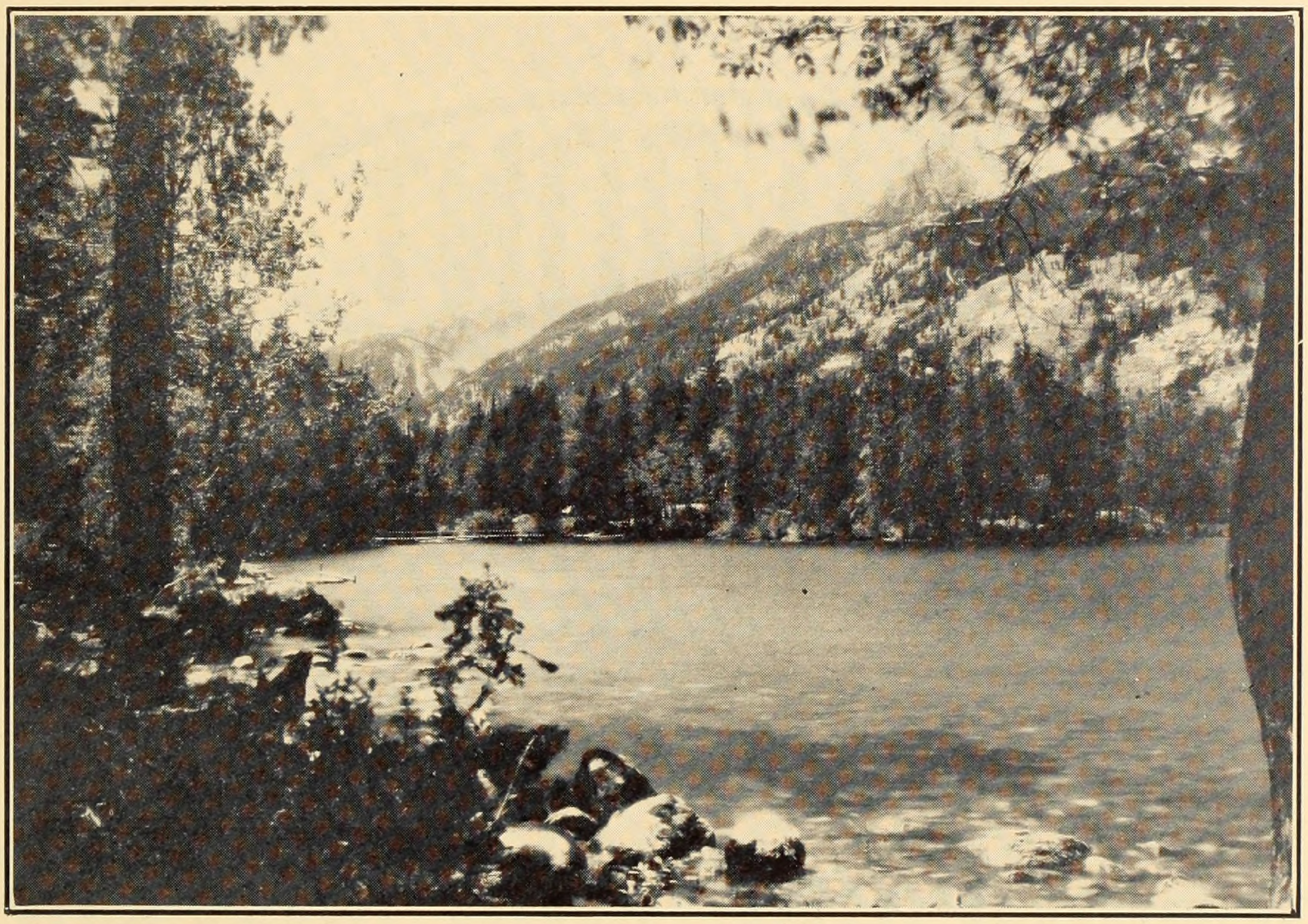
of Cinematographers



View of Yellowstone Lake, Yellowstone National Park. Reproduced from Location Library of American Society of Cinematographers, Hollywood.

Cleaning Liquids for Motion Picture Film—By J. I. Crabtree and H. C. Carlton; Traveling—for Pleasure!—By Len H. Roos, A.S.C.; In Cameraformia.

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Vol. VIII MAY, 1927 No. 2

American Cinematographer

Foster Goss, *Editor and General Manager*

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Amateur Cinematography

A Professional's Notes for Amateurs

Part VII

By Jos. A. Dubray, A. S. C.

Discoveries of della Porta and Others in Primitive Photographic Research Related

(Continued From Last Month)

Jos. A. Dubray

The main shortcoming of a pin-hole image is its lack of illumination, i.e., its faintness, which renders it impractical for either viewing it or for forcing it to make an impression on a substance sensitive to light.

Della Porta himself, tried to correct this sole deficiency of the image obtained in his apparatus.

Once establishing the impossibility of admitting a greater volume of light in the camera obscura by enlarging the size of the pinhole, he discovered that by forcing the rays of light emanated by the object, to be refracted by a converging *lens,* he would obtain an image, not orthoscopic in the full meaning of the word, but possessing sufficient definition to justify its use, taking into consideration the tremendous increase of illumination of the image.

A *LENS* can be defined as *"any transparent medium bounded by regularly curved refracting surfaces* (one of the surfaces may be plane.") The curvatures of the refracting surfaces are calculated so as to force all of the incident rays to meet at a certain point, which may be *behind* the lens (convergent lenses) or *in front of it,* on the imaginary prolongation of the refracted rays (divergent lenses.)

It is evident that any transparent and isotropic substance may be used for the making of lenses, and that each surface of a lens may be shaped as a portion of a curved solid, of well defined size and of regular geometrical form.

LENSES are named according to their shape, so if their surfaces are portions of spheres, they will be called "spherical," the same appellation applying when one of their surfaces is plane.

If the surfaces are portions of cylinders, the lens is called cylindrical.

If one of the surfaces is a portion of a sphere and the other portion of a cylinder, the lens will be called "sphero-cylindrical" and so on. Lenses may be parabolical, toroidal, etc., according to the shape of their bounding surfaces.

IN photography, only *spherical* lenses made of *glass* are used.

The spherical form has been chosen because of the relative easiness in which such shapes may be obtained with the extreme exactness that is required, and *glass* is the material used, because of its transparency, its resistance to extraneous influences and its chemical stability.

Generally speaking, *glass* is a compound of silica with metallic oxides and two main divisions are derived from such combination.

Crown glass is a compound of silica and *lead,* with soda or potash, or both.

During the latest years, new elements have been incorporated in glass in order to change its molecular composition and adapt it to the exact requirements of modern optical instruments. We shall in the course of this study anaylze the tremendous improvements thus incorporated in the manufacture of optical glass. It will suffice in this article to give a synopsis of Schott's account of the process for the manufacture of ordinary optical silicate glass, as employed at Jena in 1888. This synopsis will give the reader a fair idea of the extreme care that is exercised in such process.

IT IS very difficult to produce glass without *stress,* or the formation of irregular veins which form during the solidification of the melted ingredients. *"Fine annealing"* is the remedy for this, and consists in cooling the glass from an approximate temperature of 465° Centigrade to the lowest hardening one of 370° Centigrade, very gradually, during a period of weeks.

A melting pot is heated for four or five days, at red-hot temperature, and placed in a melting furnace for five or six hours until it reaches the melting temperature of glass. Some of the glass left over from other meltings is poured in, and the crucible is glazed with an iron ladle. The pot is then ready to receive the glass mixture.

The filled pot is left at a high and very even temperature for from six to eight hours, at the end of which time the fire is moderated, the scum formed on the surface of the melted mixture is removed, and a red-hot stirrer of fire-clay is placed in it and left for one hour.

Then the stirring begins, using as handle to the stirrer, a long iron tube kept cool by a current of water.

The mixture is tested from time to time by blowing small flasks with a glass-blower pipe. Stirring will be complete in from three to four hours, during which time the mass has been allowed to gradually decrease somewhat in temperature.

(Continued on Page 20)

The EDITOR'S LENS ❦ ❦ focused by FOSTER GOSS

Studio Promotions

AN INTERESTING item, by Charles M. Steele, appears in the current number of "Film Boards of Trade Bulletin," as follows: "One of our present managers started with First National as a shipping clerk. He was first promoted to the booker's desk because he was a top-notch shipper and kept everything in apple pie order. Then he was made salesman because as a booker he put into practice the slogan that 'The best is none too good.' As a salesman, he always put his best foot foremost. And now he manages a branch, every department of which appears in its 'Sunday Best' every day in the week."

¶ All of which shows the fact that the sequence of promotion in the distribution end of the film industry is much the same as it is in other lines of business. But is it so in motion picture production?

¶ Occasionally, there is reported a "rags to riches" yarn concerning the phenomenal rise of some individual from an humble to a mighty position in a studio. Thus, the making of motion pictures is generally believed to present opportunities such as might only be obtained through the possession of an Alladin's lamp. That there are great opportunities within studios, there can be little question.

¶ The point of our observations here, however, is that these opportunities very often do not fall in the hands which deserve them most. With stability and efficiency having become the watchword of studio heads, there has arisen the natural desire—political situations excepted—to keep a man in the job with which he has become successfully identified. Hence, once a man has become known as an efficient publicity man, he remains a publicity man. The ultimate of his advancement is the head of his studio's publicity department. This is abundantly and specifically illustrated in a number of Hollywood instances. That many of these men have the natural ambition to enter the writing division of production, that by previous training and by long experience within their particular studio, they are fitted for this promotion concerns not their superiors. They have proven themselves successful press agents in which capacity they are no longer unknown quantities—and experiments are costly! Therefore, the vacancies in the scenario departments are passed on to comparative newcomers with a minimum of experience in the actual lore of the studios. The seeming result is that, instead of having two new men in two new positions, there is only one in a strange environment while the other remains cataloged as theretofore. As an idea of super-efficiency this all may seem well enough, but it does not squarely reckon with a thing so thoroughly human as ambition. Past occurrences seem to point to the fact that the publicity man, in our hypothetical case, would not only have the ambition to make good in the higher step in the studio, but would likewise be fortified with the necessary pre-requisites in the way of training—which the stranger, despite incidental success in the theatre or kindred lines would not possess. So the press agent goes along with his old job—or, if he becomes sufficiently worked up, resigns to take his chances at getting to do what he really wants to.

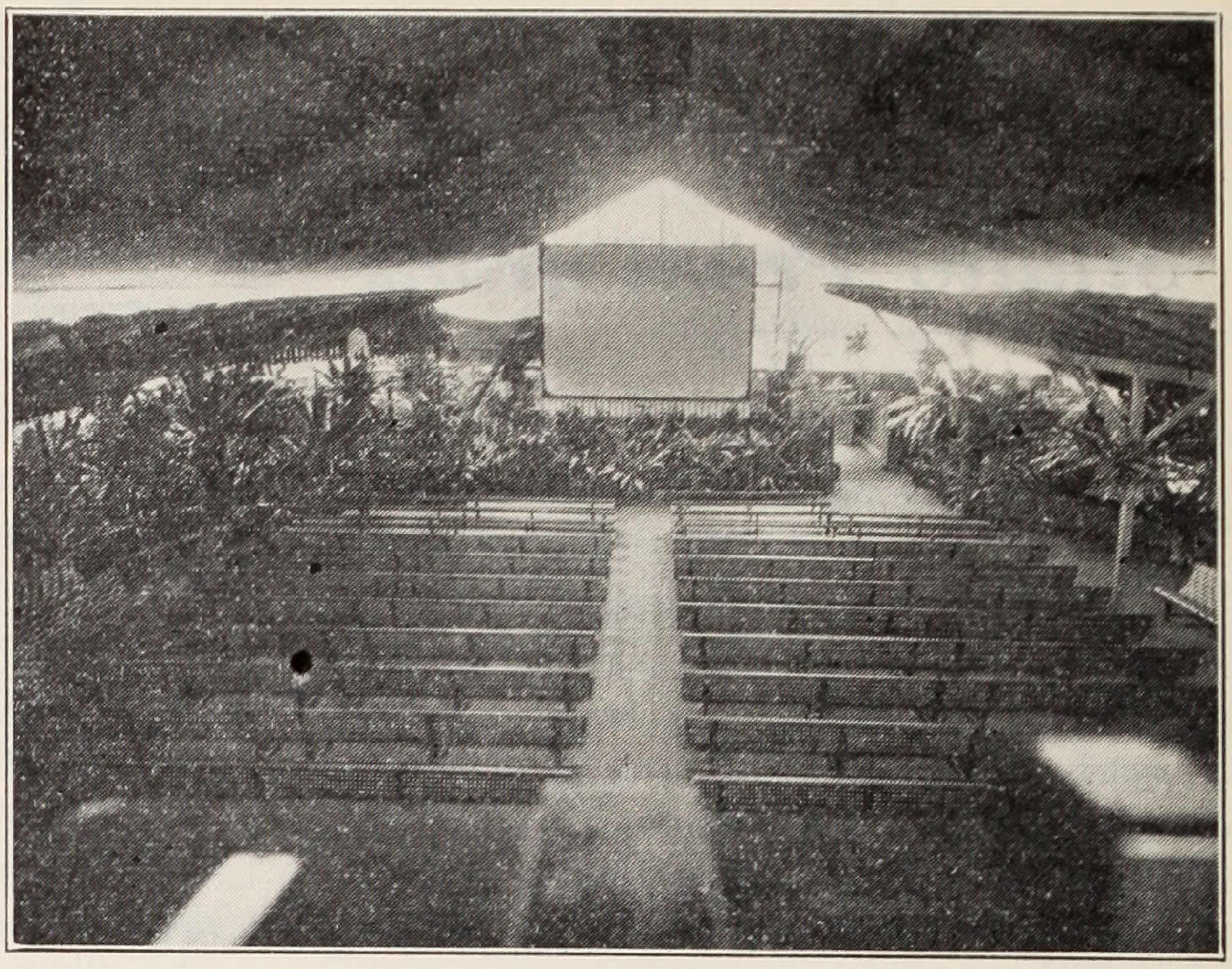
¶ So it is with the cinematographer. Thoroughly capable to direct, on account of his unparalleled opportunities to study directorial methods, of all that he has absorbed concerning the handling of players, and of his intimate knowledge of the camera, he is told that as a prospective director, he is a good cinematographer. (Besides, what would the new and green directors do if they did not have a seasoned cinematographer at their sides?)

¶ The moral seems to be, in this peculiar cross-section of production, is not to become too good at any particular calling, or one will never do anything but that. This is simply another way of prescribing the limits of a man's professional growth. Executive imagination is not required to observe that a man is making good in his job. Imagination is required, however, to see where a man could be more efficient—and brilliant, if you please—in a higher post, both for himself and for his company. When, then, will it become the rule, rather than the exception, that cinematographers are given their deserved chances to direct?

Traveling—for Pleasure!

What Camera Globetrotters Must Contend With

By Len H. Roos, A.S.C.



The Rink Pictures, Casino, N.S.W., Australia.

This semi-tropical theatre has a canvas roof and tropical plants are placed along the sides. All the best American releases are screened here—often simultaneously with the showings in Sydney. (Credit titles are left in the prints at this theatre). Two features, a comedy, a scenic and a news reel usually make up the program. Average admission price is about 25c. Best seats are 'way back under the projection room. T. J. Dorgan, owner.

THE scene may be laid in the smoking lounge of a trans-Pacific liner, or in a compartment in a railway carriage. The formula is always the same. I may be comfortably seated with a book when some passenger with a cap a couple of sizes too small, a flowing mustache and a painfully new checked suit will remark: "Nice boat, this."

This calls for an answer and, duly given, the pest then tenders the information that he has left his hardware business in Duluth to the tender mercies of his son-in-law and is "taking a trip—for pleasure."

Nature of Beast

Every time someone tells me he is traveling for pleasure I feel I must get a thorough look at the informant. I have been tempted to argue with these ubiquitous "pleasure travelers" at times, with the idea of finding out what pleasure they can derive from traveling.

It's no use. They don't know themselves. They are real Sherlock Holmes' in finding out one's business, and, after being told, they come to the conclusion "that it must be a great job."

They won't be told that passing cameras through customs in foreign countries is a job that calls for all the ability and tact of a high grade diplomat.

Stay on Beaten Path

They get a lot of fun out of kicking about terrible hotels, because they don't have to stay in them. They stop where they can get cool drinks and good beds—but where it is impossible to get interesting pictures. They don't go to out-of-the-way places where the heat, flies, mosquitoes and a hundred other pests would drive a person crazy. They see "the sights" from a comfortable motor car and don't have to pack a heavy camera around. They find fault with everything. They kick about exorbitant charges, poor service, and maintain that they wouldn't put up with this for a moment at home; and yet they will leave a comfortable home, where they can unpack all their belongings and have everything they want right handy, to travel—*for pleasure!*

Exhibitors

I meet exhibitors in out-of-the-way places and usually have to spend an evening with them answering questions about theatres at home; their methods of presentation.

"Do I think he paid too much for 'The Missing Fish Bowl' "; "What's Tom Mix like?"; "What do I think of his program?"; could he "do better with Geewhiz productions?"—and I am supposed to be the oracle that can answer all these questions after a hard day with the camera in the heat and flies. And when I say "good-bye," he says: "You certainly have a great life."

And when I have just unpacked at my base all my belongings, I get word to pack them up again and continue to Singapore. When I get there, I'll have to go through the same thing. The customs will pull my trunks to pieces; they'll want to take my cameras apart, and, after looking over everything, they'll look up the highest tariff in the book and I'll have to pay it and "get a refund when I leave the country"—maybe.

Some day I'm going to get a house; unpack everything; throw books and things around; have cushions, ashtrays and a real refrigerator with ice in it, and a good cook. Then I'll take off my shoes,

(Continued on Page 7)

O'Connell, Zucker Elected to A.S.C.

Pair of Cinematographers with Enviable Records Awarded Membership in Society

L. WILLIAM O'CONNELL and Frank C. Zucker have been elected members of the American Society of Cinematographers, according to an announcement from the A.S.C. Board of Governors.

O'Connell, who at present is identified with the William Fox studios, has been a cinematographer for the past nine years, prior to which he served for one year in the Rothacker-Aller laboratories, Chicago.

To Siberia

In 1918, he photographed J. Stuart Blackton's production, "Missing," for Famous Players-Lasky, but shortly thereafter entered the United States army and spent a year in the photographic service in Siberia.

Back to Camera

He resumed his cinematographic career in 1920 when he filmed "Peg O' My Heart," a William de Mille production for Paramount. In 1921, he did "The Skywayman" and "The Little Gray Mouse" for Fox; and "The Sky Pilot" and "A Broken Doll" for King Vidor. In 1922, he filmed "Come On Over" for Goldwyn, after which he began a connection with Clara Kimball Young which extended into 1923. Among the productions in which he photographed Miss Young were "The Hands of Nara," "Enter, Madam" and "The Woman of Bronze." His next photoplay was "An Old Sweetheart of Mine" for Harry Garson. He completed his record for 1923 with "The Fourth Musketeer" for F.B.O.

In 1924, O'Connell photographed Cosmopolitan's "Through the Dark"; " The Hill Billy" with Jack Pickford; and Vitagraph's "Behold This Woman," "The Beloved Brute" and "The Clean Heart." He began 1925 with "The Redeeming Sin" for Vitagraph, after which he moved his camera to First National for "My Son," with Nazimova, and "Sundown." He ended the year by doing the Nativity sequence in Metro-Goldwyn-Mayer's "Ben Hur."

Frank C. Zucker

He spent the fore part of 1926 filming three Chadwick productions—"The Bells," with Lionel Barrymore; "The Unchained Woman" and "April Showers." Then followed "The Lunatic at Large," with Leon Errol, for First National; and "Sir Lumberjack" for Harry Garson. Following the latter production, he started his present affiliation with Fox, having lately photographed "Gaby," "Cradle Snatchers," "Slaves of Beauty" and "The Monkey Talks."

Zucker

Zucker, who is stationed in New York City with Robert Kane productions at the Cosmopolitan studios, started camera work with the old World Film company, at the Peerless studio, in 1916.

Among his earlier efforts were two serials with Helen Holmes, "Beware of the Law" and "Darkness and Daylight," all for Warner Brothers. He then was chief cinematographer on "The Silver Lining" for Roland West. There followed two features, "Holdane of the Secret Service" and "The Man from Beyond," starring the late Harry Houdini, whereupon he was chief cinematographer on a pair of features for Chadwick — "Meddling Women" and "The Midnight Girl." A trio for Associated followed—"Camille of the Barbary Coast," "Broken Hearts" and "The Mad Marriage"—after which he did another for Chadwick—"Lying Wives." For Wesley Ruggles he filmed "The Man of Quality" and "The Kick-off." These were succeeded by "Insinuation"; a series of six pictures, "Flying Fists," with Benny Leonard, and "The Lunatic" for Harry Garson.

Also in Siberia

Like O'Connell, Zucker also has seen cinematographic experience in Siberia, having made a trip through its interior in 1922 and photographed 100,000 feet of film for W. K. Zeigfeld.

Traveling--for Pleasure!

(Continued from Page 6)

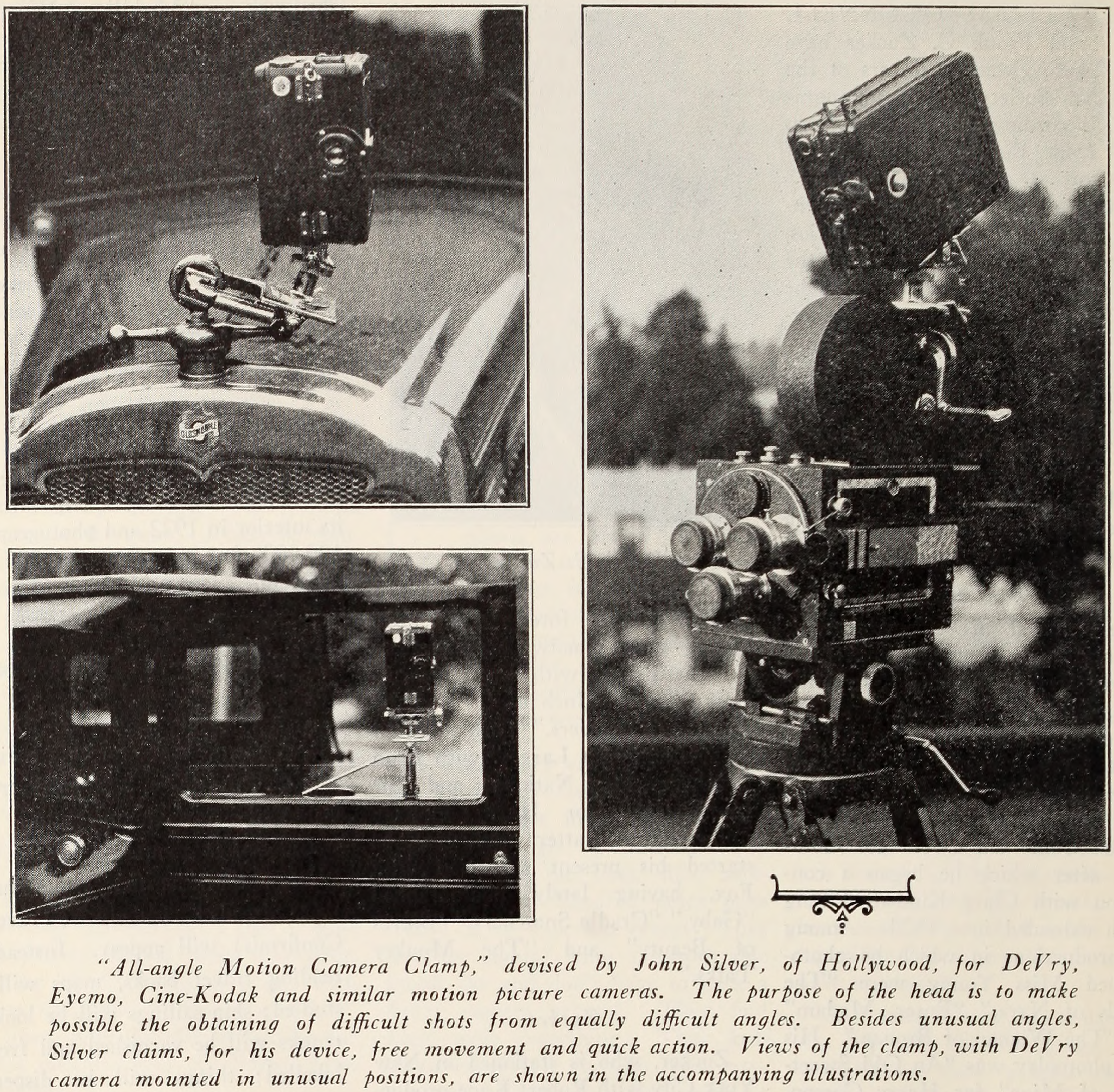
get in the most comfortable chair in the place, pick out a good travel book and—travel for pleasure.

But—after about a week of this, I know that the first symptoms of that dreaded malady (Travelitis Confirmis) will appear. Instead of reading travel books, maps will be studied; ship sailings will be looked; trunks will be varnished and freshly labelled; things will be dispensed with that I know I'll need in a month (and probably will never need); lists of subjects will be compiled and submitted to the buyers of travel material in New York and London.

And then the ship will be about two days out of port when some one will interrupt my reading to say: "Nice Boat, this"; and his name will be Jones and he just turned his hardware business over to his son-in-law in Duluth and is *traveling — for pleasure!*

A New Small Camera Head

Tripod Head for Small Cameras Designed to Clamp at All Angles in Different Positions



"All-angle Motion Camera Clamp," devised by John Silver, of Hollywood, for DeVry, Eyemo, Cine-Kodak and similar motion picture cameras. The purpose of the head is to make possible the obtaining of difficult shots from equally difficult angles. Besides unusual angles, Silver claims, for his device, free movement and quick action. Views of the clamp, with DeVry camera mounted in unusual positions, are shown in the accompanying illustrations.

Civil Service Vacancies *for* Blueprint, Photostat Operators

Examinations for under blueprint operator, junior blueprint operator, under photostat operator, junior photostat operator, and junior photostat and blueprint operator, are announced by the United States Civil Service Commission.

Applications for the positions named above must be on file with the Civil Service Commission at Washington, D. C., not later than May 28. The date for assembling of competitors will be stated on their admission cards and will be about ten days after the close of receipt of applications.

The examinations are to fill vacancies in the Departmental Service, Washington, D. C., and in positions requiring similar qualifications.

The entrance salary for the under grade positions is $1,140 a year, and for the junior grade positions $1,320 a year. A probationary period of six months is required; advancement after that depends upon individual efficiency, increased usefulness, and the occurrence of vacancies in higher positions.

Competitors will be rated on practical questions, and their education, training, and experience.

Full information may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. civil service examiners at the post office or customhouse in any city.

Cleaning Liquids for Motion Picture Film

By J. I. Crabtree and H. C. Carlton

First Installment of Treatise on How to Remove Foreign Substance from Cine Stock

(Communication No. 306, from the Research Laboratory of the Eastman Kodak Company, and appearing in Transactions of Society of Motion Picture Engineers.)

IT IS necessary to clean motion picture film at various stages in its progress from the laboratory to the theatre to remove:

1. Dirt on the base side of negative or positive film.

2. Dirt or grease which may accumulate on negative film during printing.

3. Dirt and oil which accumulates on positive film during projection.

1. When proceeding in the laboratory by the reel and tank system, if all excess water is not removed from the film previous to drying, any dissolved salts present in the water supply remain on the film after evaporation of the water. The residual salts are usually only visible on the base side of the film because on the emulsion side they have an opportunity to diffuse within the gelatin coating during drying.

It is necessary to clean the back of the dried film either by wiping with a damp chamois while on the dying reels or by passing the film through a cleaning machine. Such treatment is unnecessary in the case of positive film if all excess water is removed previous to placing on the drying reel by thorough wiping or squeegeeing.

In the case of negative film it is customary to wind it with the emulsion side downward onto a wooden drum covered with cloth when the base side may be cleaned without danger of injuring the image. The cloth should be removed from the drum at frequent intervals for cleaning.

A suitable cleaning liquid for the above purpose should possess the following properties:

(a) It should be capable of dissolving traces of inorganic salts and should also dissolve or emulsify grease and mineral oil.

(b) It should be sufficiently volatile and should not cause the gelatin side of the film to swell in a period of several seconds if it accidentally has access to it.

(c) The liquid should not affect the physical properties of film with safety or nitrate base or remove the color from film with tinted base.

A suitable mixture fulfilling the above conditions is the following:

	Metric	Avoir.
Ammonia (Conc.)	5 cc.	2-3 oz.
Water	95 cc.	12 oz.
Denatured alcohol (see below) to make	1000 cc.	1 gallon

The ammonia serves to emulsify any traces of grease or oil, while the mixture contains sufficient alcohol to prevent dangerous swelling of the gelatin if any of the mixture reaches the emulsion side of the film.

A choice of several alcohols for preparing the above liquid is available as follows:

Grain alcohol (ethyl alcohol)—This is the most satisfactory for the purpose since it has a minimum effect on the film base.

Denatured alcohol—Ethyl alcohol is available containing a variety of denaturants. The most common denaturant is wood alcohol, which dissolves nitrate film base so that this should be avoided if possible.

The most commonly available denatured alcohol is motor alcohol. The "Pyro" brand of the Industrial Alcohol Company is prepared according to the following formula, No. 5 of the U. S. Internal Revenue Bureau:

Ethyl alcohol	100	volumes
Wood alcohol	2	volumes
Pyridin bases	0.25	volumes
Kerosene	0.5	volumes

On diluting this with water the alcohol turns milky owing to the kerosene coming out of solution. Kerosene has no effect on the film base or gelatin coating and serves to dissolve grease. Although pyridin and wood alcohol attack the film base when pure, in the above concentration and when diluted with water in the above formula they have no harmful effect on the film base during the time required for cleaning. The above cleaning liquid prepared with "Pyro" motor alcohol had only a slight tendency to produce curl on film with nitrate or acetate base after complete immersion for 24 hours at 70° F.

Isopropyl alcohol—This is now available commercially and the "practical" grade is satisfactory for the purpose. It does not turn milky on mixing with water and has little or no curling effect on film with either nitrate or acetate bases, even on immersion for several hours. It is non-poisonous,[1] is not decomposed on exposure to light and when used in the above mixtures does not attack the silver image or the gelatin coating.

Tertiary butyl alcohol is also available commercially and has properties similar to those of isopropyl alcohol. Its odor, however, is somewhat objectionable.

All the above alcohols tend to remove more or less of the tint from nitrate or safety tinted base film but the water present in the above cleaning liquid greatly retards this action.

The precise effect of cleaners prepared with the various alcohols on the tinted base is shown in the following table. Samples of film were immersed in the cleaners and the times required for visible signs of removal of the color were observed.

Effect of Film Cleaning Liquids on Tinted Base Film

Formula	Safety base	Nitrate base
Ammonia (conc.).. 5 cc. Water .... 95 cc. Motor alcohol to....1000 cc.	Liquid slightly colored in 10 minutes.	Same as safety base.
Ammonia (conc.).. 5 cc. Water .... 95 cc. Isopropyl alcohol to ....1000 cc.	No effect in 2 hours.	Liquid slightly colored in 10 minutes.
Ammonia (conc.).. 5 cc. Water .... 95 cc. Tertiary butyl alcohol to ....1000 cc.	Slight effect in 1 hour.	No effect in 16 hours.

The propensity of the cleaner to remove the tint varied with the different colored bases but the above table gives data for the base which was most readily attacked. Since the period of application of the cleaning liquid is very much shorter than that required to visibly affect the tinted case, the cleaners are considered satisfactory.

2. When making positive prints from negative film, the negative accumulates more or less dirt, grease, and loose particles of dust which must be removed at frequent intervals. In any case it is advisable to remove dust after every third or fourth passage through the printer by passing through silk plush (cut on the bias) moistened with a suitable cleaning liquid as the film is being wound on a rewinder. More thorough cleaning of the emulsion side can be effected by winding the film base side downward on a cloth-covered drum as above.

The requirements of a suitable cleaning liquid for this purpose are similar to those for positive films dealt with below.

3. Positive film accumulates more or less dirt and oil during its passage through the projector, which causes spots and patchiness on the screen. In this connection film which has been toned has a greater tendency to show oil spots than untoned film, which is presumably a result of the matte surface produced by certain toning processes. The oil and dirt may be effectively removed from the film by immersing in a suitable oil solvent, with or without scrubbing, and then removing the excess solvent by squeegeeing and buffing. A satisfactory machine for this method of applying the solvent is by means of silk plush as the film is being wound on a rewinder.

Various liquids have been suggested for the above purpose but the precise effect of such liquids on the film base and on the image, so far as is known to the author, has not been investigated. Moreover, in certain cases deterioration of the film image has been definitely traced to the use of unsuitable chemicals. An investigation to determine the most suitable liquids for the above purpose therefore seemed dsirable.

Requirements of a Suitable Film Cleaning Liquid

A suitable film cleaning liquid should possess the following properties:

1. It should readily dissolve fats and mineral oils.

2. It should not affect the gelatin coating or the film base, or remove the color from film with tinted base. Also it should not attack the silver image or a tinted or toned image even on prolonged contact in the presence of moisture, because when cleaning on a rewinder any excess of solvent which does not evaporate is trapped between the convolutions of the film, when it can evaporate only very slowly.

It should also not decompose on exposure to light to give products which are injurious to the film.

3. The boiling point and latest heat of evaporation should be such as to permit of sufficiently rapid drying.

4. It should be non-combustible, non-toxic, and be readily available at a reasonable price.

At the outset a survey was made of all the possible commercially available non-inflammable and inflammable oil solvents, and the most promising of these were investigated as follows:

Non-Inflammable Oil Solvents

The following compounds were selected by virtue of their suitable volatility, solvent action, and price:

Solvent	Formula	Boiling Point
Dichlorethylene	$C_2H_2Cl_2$	56- 60°C.
Trichlorethylene	C_2HCl_3	85- 87°C.
Tetrachlorethylene	C_2Cl_4	119-121°C.
Ethylene dichloride	$C_2H_4Cl_2$	83°C.
Carbon tetrachloride	CCl_4	76°C.

The effect of these compounds on the film was investigated as follows:

Effect of Non-Inflammable Solvents on Motion Picture Film

The effect of the above solvents on film was studied by placing a strip of developed positive motion picture film (nitrate base) in a 100cc. stoppered bottle with 40cc. of the solvent and 3cc. of water at room temperature. The film was thereby subjected both to the liquid and its vapors. Any tendency of the film to curl or of the image to change color was observed after 18 hours with the following results:

Solvent	Condition of Film (Nitrate base) after 18 hrs. at 70°F.
Dichlorethylene (pure E. K. Co.)	Slight curl when wet. Bad curl when dry. No effect on image.
Trichlorethylene (Com. E. K. Co.)	No effect on film base. Emulsion softened and image obliterated.
Trichlorethylene (pure E. K. Co.)	No effect on image or film base.
Tetrachlorethylene (Dow)	Slight curl when dry. No effect on image.
Ethylene dichloride (pure E. K. Co.)	Bad curl. No effect on image.
Carbon tetrachloride (Dow)	No effect on base or emulsion.
Carbon tetrachloride (pure E. K. Co.)	No effect on base of emulsion.

Any curling tendency in the above tests was an indication that the film base had been attacked. The tests show that dichlorethylene and ethylene dichloride exert a sol-

(Continued on Page 20)

Panchromatic Motion Picture Film Negative

Conclusion of Masterful Paper on Widely Used Kind of Motion Picture Stock.

By Loyd A. Jones and J. I. Crabtree

Final Facts Presented in Communication from Eastman Research Laboratories.

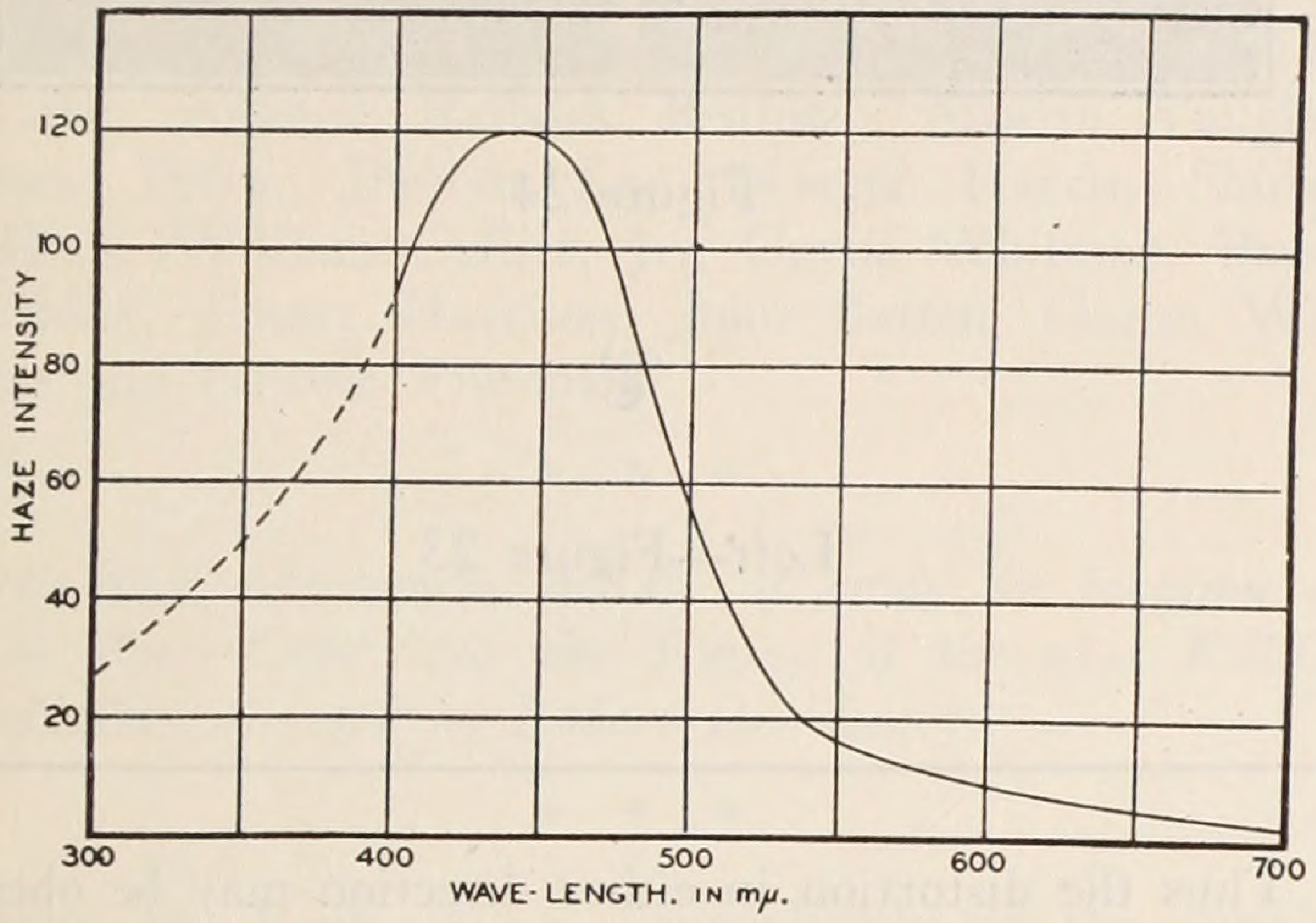


Figure 21

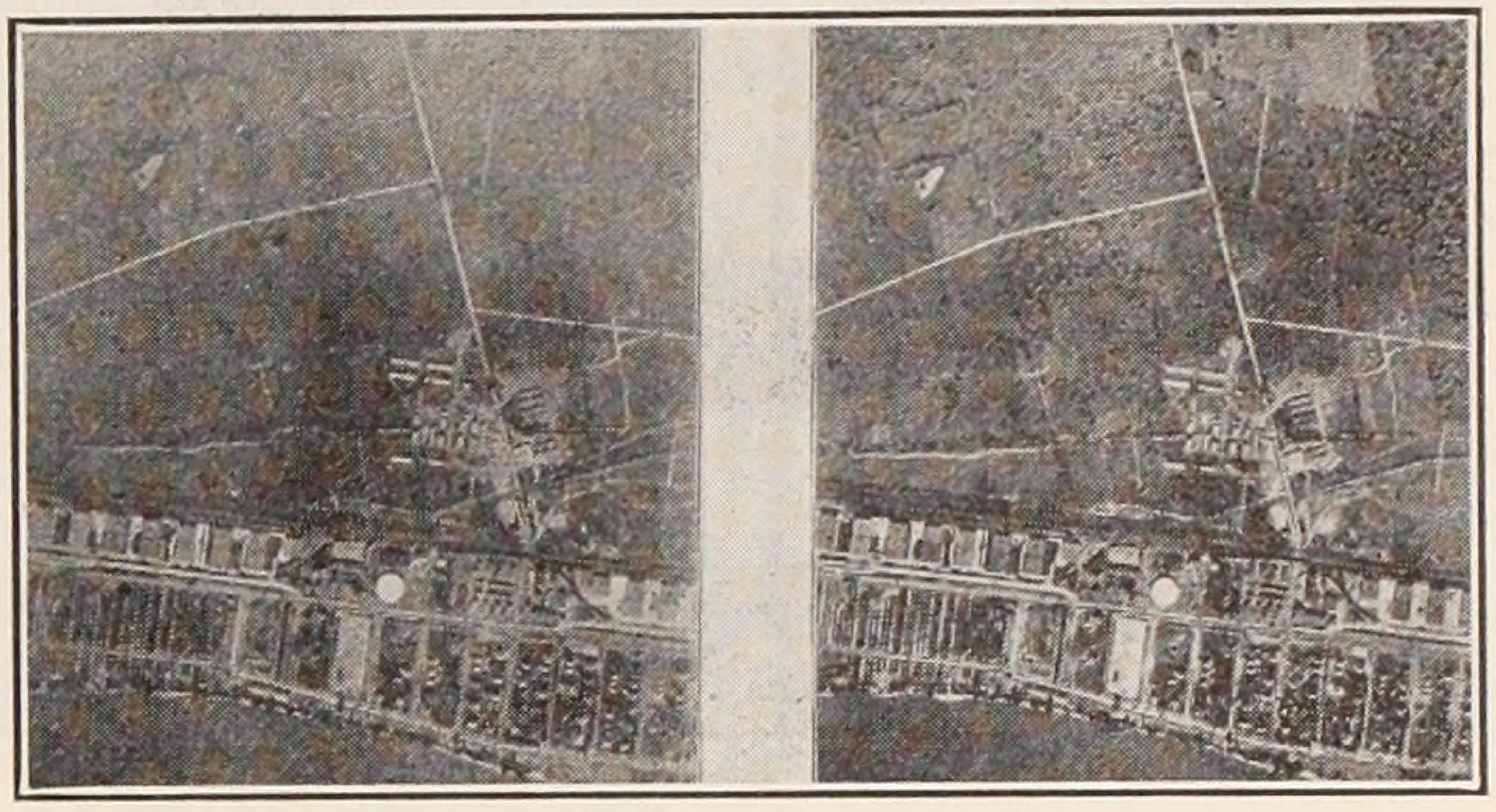


Figure 22

(Continued from Last Month)

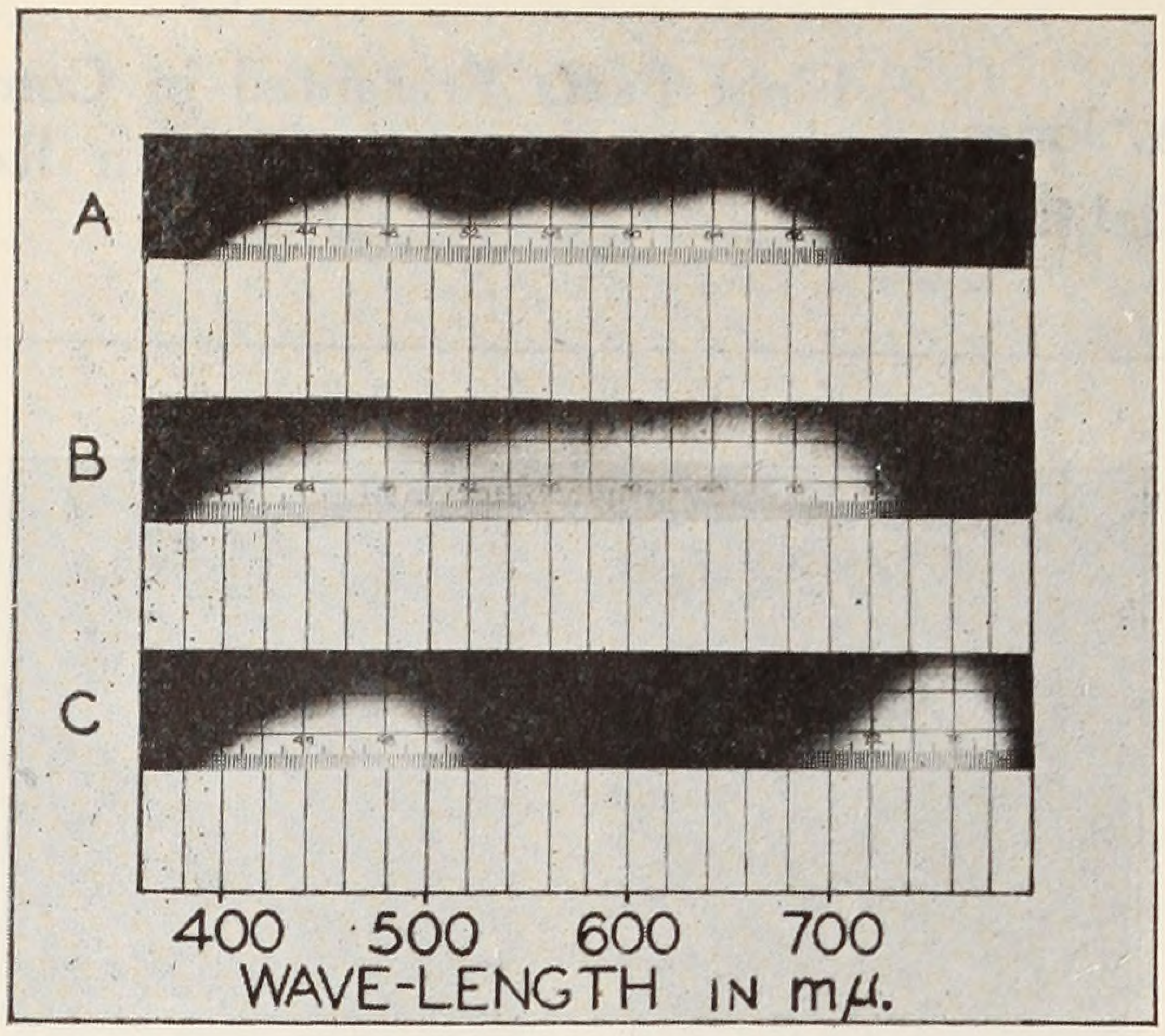
THE predominance of *warm* colors in studio work has already been mentioned. At first thought it may seem almost impossible to make any general statements relative to what colors are used predominantly in motion picture sets. It should be remembered, however, that the sets created in the studio merely imitate the homes and surroundings of every-day life. A careful consideration of the subject indicates that the vast majority of the walls, draperies, and objects with which we surround ourselves are characterized by the warm colors. This fact tends to make the effective speed of panchromatic film much greater than that indicated by the values based upon white light measurements. There is little doubt that if panchromatic film is adopted for studio use illumination levels much lower than are at present used will be adequate for obtaining satisfactorily exposed negatives. The preponderance of red, orange, yellow, yellow-green, and green and their related shades and tints in studio work and the relatively high sensitivity of panchromatic film to the red end of the spectrum are very favorable toward the use of high efficiency tungsten lamps for studio illumination. As mentioned before, these sources have many virtues to recommend them. A studio set lighted by tungsten should produce an atmosphere differing less from real life surroundings. It seems reasonable to suppose that the dramatic artists should respond to this condition and be better able to portray their rolls with realism.

Limits of Colors

Attempts have been made in the construction and decoration of studio sets to use only black, white, and grays. Certainly when using non-color sensitive film this offers advantages in enabling the artist, camera man, and director to determine with certainty the composition of the picture in light and shade as it will appear on the screen. No objection to such procedure exists from the standpoint of the audience since they have no means of detecting the absence of color in the sets. Our information is that these attempts were failures because the actors in these sets were so affected by the unnaturalness in the surroundings, due to the absence of color, that they could not do good work. This seems to be good evidence in the support of the contention that naturalness and semblance to reality in studio sets is at least helpful to satisfactory dramatic performance.

Duplicating Color Detail

In the making of many high class pictures every effort is made, frequently at great expense, to duplicate to the last detail the quality and color of the scene to be represented. Perhaps the action takes place in the drawing room in a home of wealth or luxury. The walls are decorated in a carefully balanced color scheme, the window openings are treated with rich fabric of harmonizing colors, oriental rugs are strewn over the floor and the ladies appear gowned in the latest creations, symphonies in color. Now comes a jaring note; the faces and arms must be plastered with a putty colored powder and the set flooded with a light which is harsh and glaring or of a quality such as to impart an extraordinary ghastliness to the scene. The use of panchromatic negative film will help to eliminate some of these objectionable conditions. Make-up can be just the same as would be worn in real life under similar conditions and the set may be satisfactorily illuminated by using light of the same general quality as would be found in such an interior.



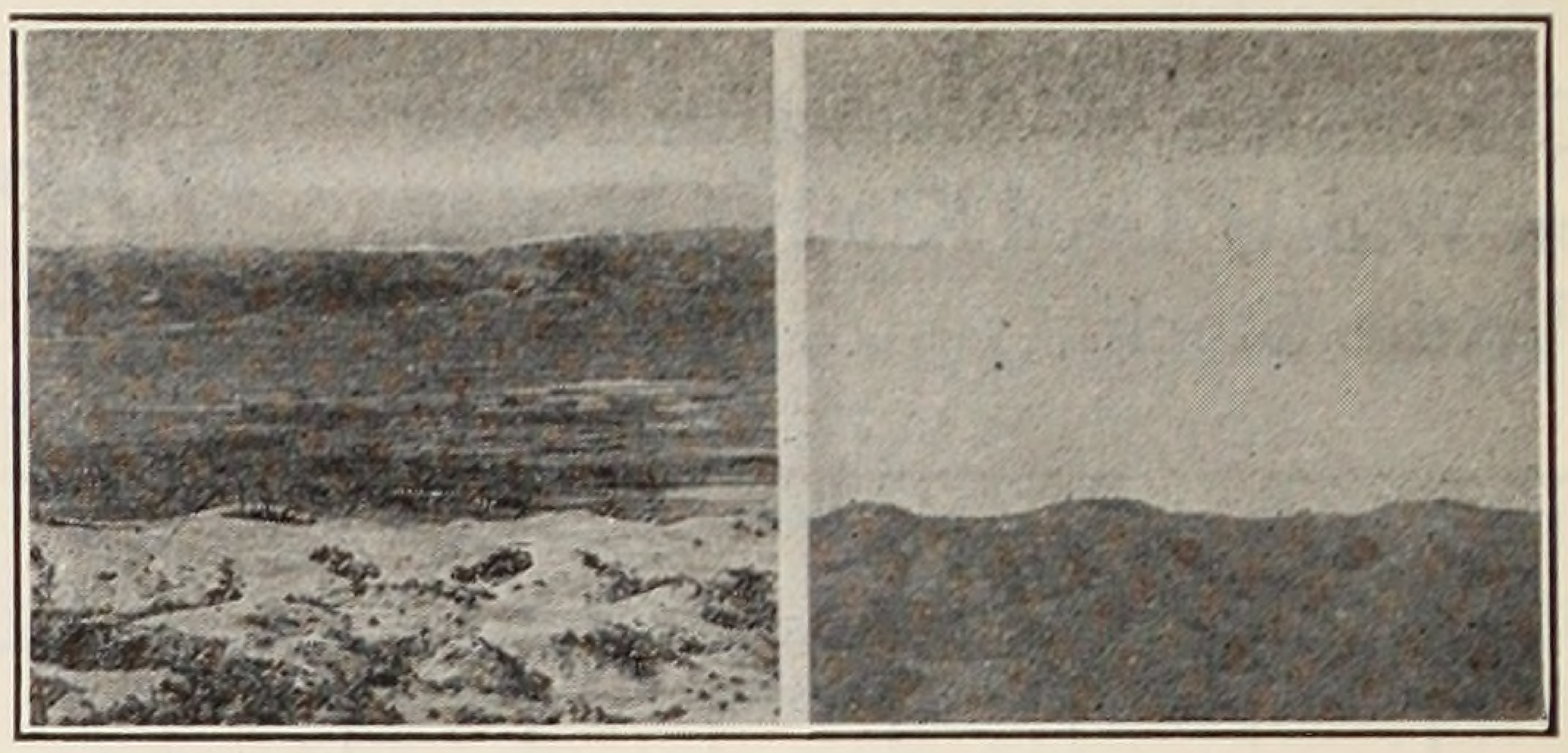


Figure 24

◆

Left—Figure 23

"Color Blind"

After having spent a great deal of thought and money in the construction and embellishment of the set in colors duplicating the original, the scene is photographed on material which is totally blind to one-half of the visible spectrum, and that half the one that includes the colors which predominate in the average interior. It is not an infrequent experience to find that the carefully balanced color scheme is rendered on the screen in such a way as to destroy completely the black and white compositions desired. The use of panchromatic film will eliminate such unfortunate occurrences.

Distorted Reproductions

It may be necessary at times to photograph a scene in which two or more adjacent elements are of different hues and saturations but identical in visual brightness. To the eye such details are visible by virtue of the *hue* or *saturation* contrast. If panchromatic film corrected by a filter designed to give correct reproduction of visual brightness is used such objects will not be differentiated in the negative record. To obtain the desired differentiation it is necessary to disturb the adjustment either by using a filter of different color or by changing the quality of the illumination. In this way distorted rendition of the visual brightness values is obtained. As an illustration of such a case consider a bright green card on which is printed a design in red. It is quite possible to adjust the two colors so that no brightness difference exists between the two colors. Photographed on panchromatic film with a filter adjusted to give correct tone values the design is invisible. Now suppose a green filter is placed over the lens. No red light is transmitted and hence the design in red is rendered in black or very dark against a light background. Or suppose a red filter is used instead of the green. The light reflected by the background (green card) is not absorbed and the design is rendered as light on a dark ground. Thus the distortion in either direction may be obtained. The operator must decide which color should be rendered as lighter than the other. This decision will depend very much upon the circumstances but in general it is best to use a filter which will render a *warm* color (one included in the red, orange, yellow, yellow-green series) as lighter than one of the *cold* group. This follows from the fact that colors belonging to the long wave-length end of the spectrum are usually brighter than those of short wave-length. Moreover it is not advisable in general to use a filter which completely absorbs one of the two colors since the great contrast thus obtained in the reproduction is much greater than the visual contrast due to the hue difference between the two colors. The general principle to be remembered is to use a filter which absorbs one of the colors to a *greater* extent than the other.

Haze Elimination

In making pictures outdoors it is sometimes desirable to obtain rendition of distant details which are partially or entirely obscured by atmospheric haze. Such haze is due to the scattering of light by dust particles or water vapor suspended in the air. In most cases haze is not white but more or less blue in color. By using panchromatic film with a filter which absorbs blue selectively the non-image-forming haze light can be absorbed to a great extent while the minus-blue (that is yellow) light from the distant parts of the scene are transmitted and give satisfactory photographic records. In Fig. 21 the curve shows the spectral distribution of energy in haze light. It will be noted that there is a very great predominance at wave-length 440 mu. The distribution on the short wave-length side of 400 has not been determined experimentally. The dotted part of the curve is an estimated extension. As shown by the curve the amount of energy in the haze light in the longer wave-length region is much less than in the blue.

(Continued on Page 16)

In Cameraformia . . .

and News Notes of the Month

JOSEPH A. DUBRAY, A.S.C., has completed the filming of the Tiffany production, "Backstage." The cast included Barbara Bedford, Alberta Vaughn, Eileen Percy, Jocelyn Lee, Marcia Harris, Shirley O'Hara, William Collier, Jr., Gayne Whitman, Bruce Benedict, Jimmy Harrison, John Batten, Guinn Williams and Lincoln Plummer.

* * *

Nicholas Musuraca, A.S.C., is away on location at Lone Pine, Calif., for the filming of the next F.B.O. production directed by Robert De Lacey.

* * *

John W. Boyle, A.S.C., immediately on the completion of "Topsy and Eva," on which, starring the Duncan Sisters, he was chief cinematographer, left for Louisville, Kentucky, to photograph racing scenes at Churchill Downs, including the 1927 renewal of the Kentucky Derby, America's classic turf event. Boyle is taking his special camera combination of Akeley-Bell and Howell outfits. The scenes which he will photograph are for use in Metro-Goldwyn-Mayer's "In Old Kentucky" which John Stahl will direct.

* * *

Arthur Edeson, A.S.C., has returned from Camp Lewis, Wash., where he filmed tank battle scenes for First National's "The Patent Leather Kid," starring Richard Barthelmess.

Creco Gets Manufacture *and* Distribution Rights *to* Patent

Creco, Inc., manufacturers of motion picture studio lighting apparatus in Hollywood, have secured operative and patent rights to the manufacture, distribution, sale and rentals of the Wallis diverging double doors, according to an announcement from Herbert Sylvester, president of Creco.

According to Sylvester, these double diverging doors are founded on the principle of simplified optics; that of a projected diffused source of light, thereby directing all of the light source on a definite objective, eliminating the fifty per cent loss in high intensity lighting apparatus used in cinematography. A further advantage is claimed in the elimination of Klieg eyes without affecting the actinic rays. These double doors will be ready for motion picture purposes shortly; and will cover 24-, 36-, 50- and 60-inch single and double diverging doors.

Charles Rosher, A.S.C., has begun photographic preparations for Mary Pickford's next production. Next month will mark the anniversary of the tenth year of Rosher's connection with Miss Pickford. During this period, which began at the old Famous Players-Lasky studio, Rosher has been chief cinematographer on every Mary Pickford production. By courtesy of the Pickford organization, Rosher has been, "between pictures" at his home studio, chief cinematographer on several of the largest features made in this country and Europe. He recently completed the cinematographic work on F. W. Murnau's "Sunrise" for Fox, and is at the present time engaged in the inspection of the release prints for this feature. Previously, he spent a year at the Ufa studios in Berlin, and had photographed photoplays in Italy and other European countries.

* * *

George Schneiderman, A.S.C., is filming "Colleen," a Fox production of an Irish racing story. Frank O'Connor is directing.

* * *

E. Burton Steene, A.S.C., freelance Akeley camera expert, has concluded an eight months' engagement with Paramount, which organization retained his exclusive services during this time for Akeley work on "Wings" and other Famous Players-Lasky productions. Much of Steene's engagement was spent in San Antonio on location for "Wings." Among the other pictures to which Steene contributed Akeley shots were those starring Bebe Daniels. A great proportion of his work was on interiors—which marks a transition in application of the Akeley, which in the past was used almost entirely for exteriors.

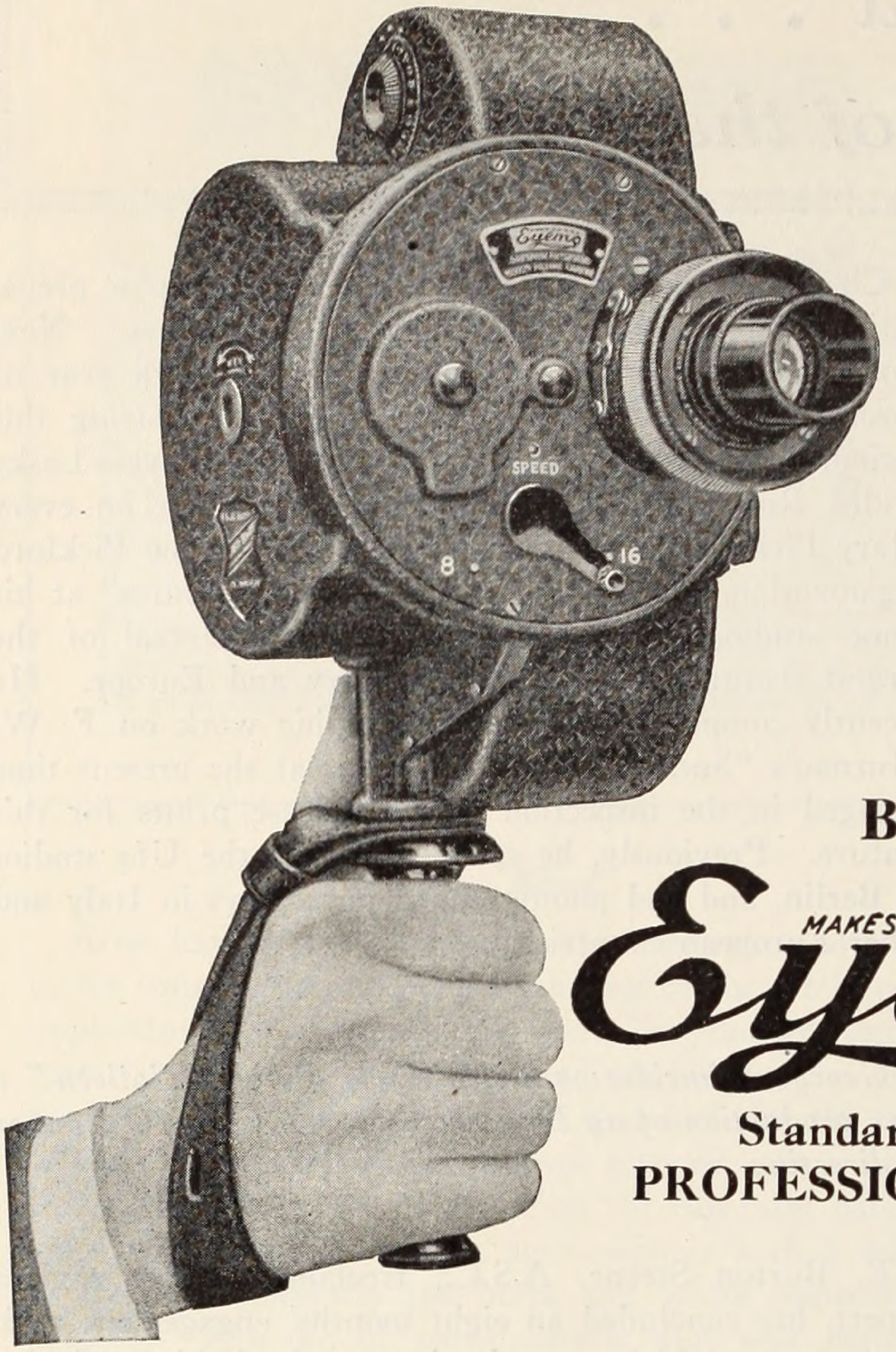
A.S.C. President Convalesces Following Second Operation

Daniel B. Clark, president of the American Society of Cinematographers, is convalescing at his home from a surgical operation which he recently underwent at the Hollywood Hospital.

The operation was performed because of the reoccurence of a similar trouble which Clark experienced last summer when he likewise underwent an operation. A premature return to work necessitated the second trip to the hospital.

Clark was taken to the hospital on the day following his inauguration for his second term as president of the A.S.C.

How BELL & HOWELL Automa



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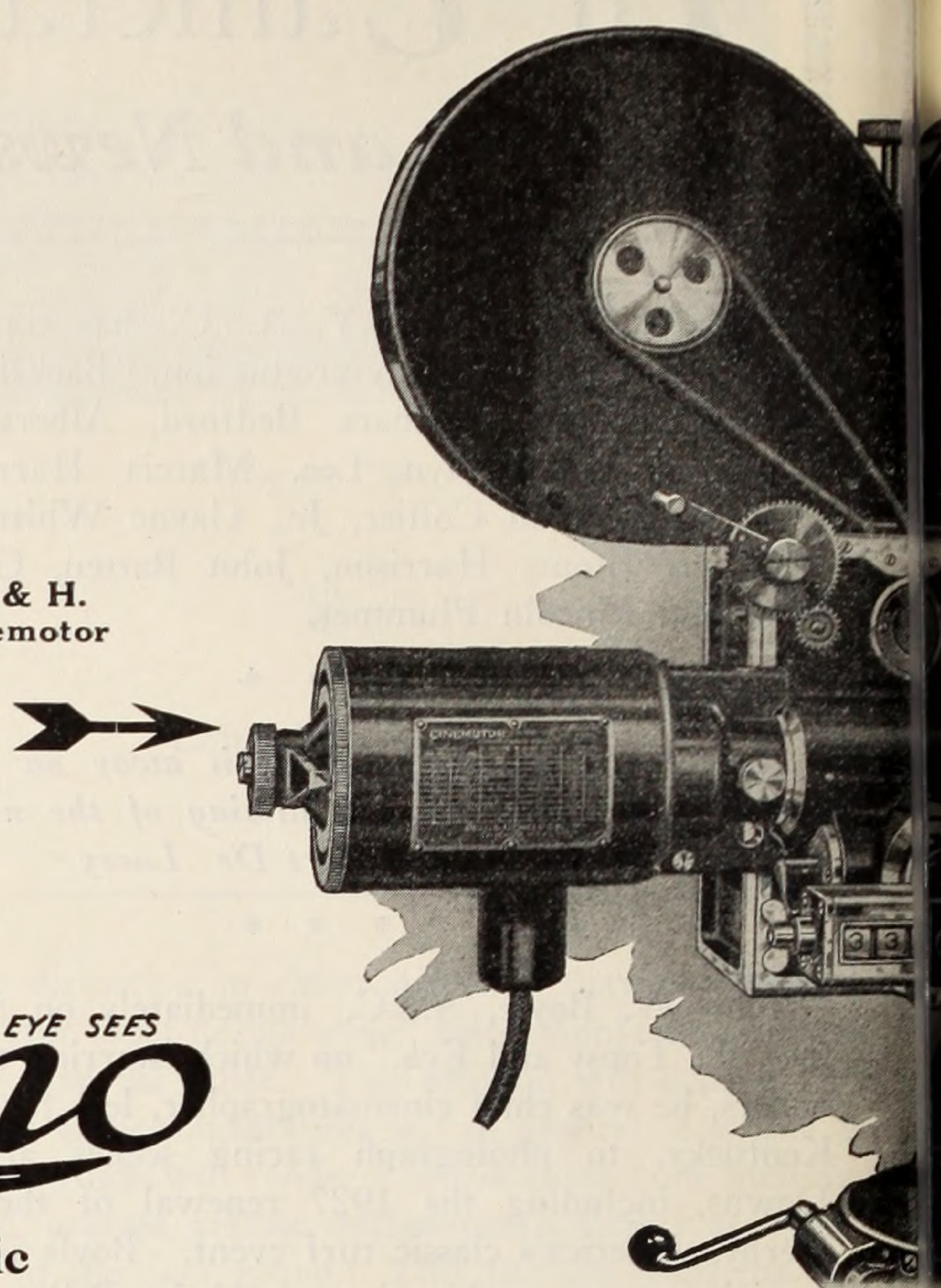

TO the experienced cameraman there is but one light, automatic standard camera which provides the flexibility and precision necessary to meet professional requirements. That is the Bell & Howell EYEMO, shown here.

To operate Eyemo, simply locate scene in the spy-glass viewfinder and press the button. The operator has one hand free to "follow focus" or "dial iris" with camera in operation. Iris stops and focus numbers are plainly visible in viewfinder. A superior lens is furnished with EYEMO—a 47 mm. F 2.5 Taylor-Hobson Cooke anastigmat in micrometer focusing mount.

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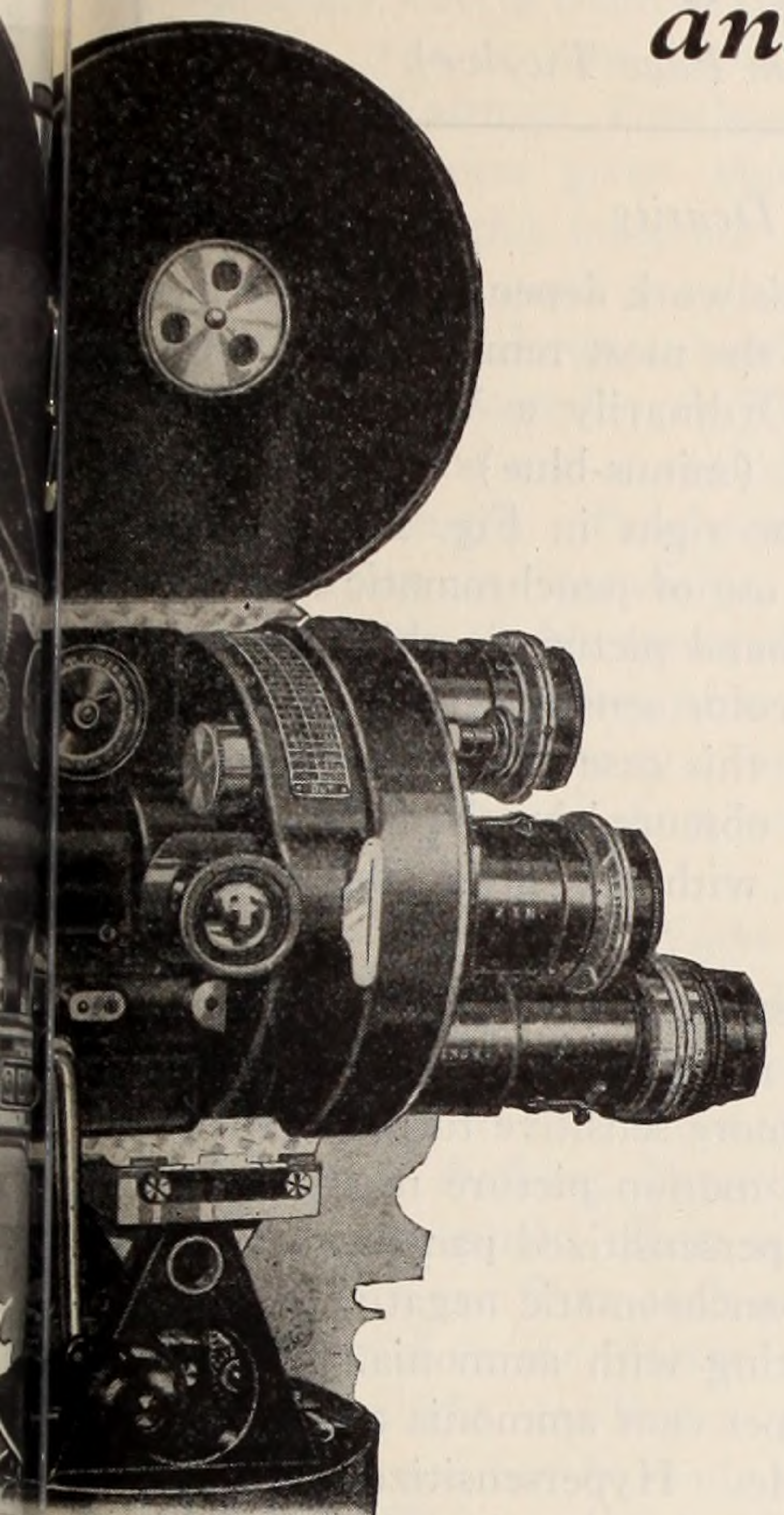

TWO of the many features which indicate why Bell & Howell Cameras are used by practically all leading producers the world over are illustrated here:

1. The Cinemotor for giving the Pioneer Standard Camera electric automatic speed control—for painting photographic artistry on the screen.

2. The portable Eyemo Automatic (spring-motor) Camera for stunt shots, news reels and locations. See brief descriptions on this page. Further information on either, or both, upon request.

Head Camera-man Harry Perry, during the filming of Paramount's great story of the American Ace, "Wings." Perry is shown here with one of his mounts, making use of the Bell & Howell Camera and Cinemotor, current for which is generated by the airplane.

Another view of Perry, ready to circle above the five-mile replica of the over-seas battle area in "Wings." The Cinemotor is ready to see that the B & H Camera "Does its stuff" without hand cranking.

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Richard Arlen preparing for "horseback action" in the filming of "Wings." Note the Cinemotor-equipped Bell & Howell Camera aloft ready to start the film purring at the right speed for the best effect.

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Panchromatic Motion Picture Film Negative

(Continued from Page Twelve)

Haze Density

The filter required for this work depends upon the haze density and the distance of the most remote object which it is desired to record. Ordinarily a Wrattan No. 8 (K2) or Wratten No. 12 (minus-blue) will give good results. The picture at the right in Fig. 22 illustrates the elimination of haze by use of panchromatic film with a No. 12 filter. The left hand picture in this figure was made on an ordinary non-color sensitive plate without a filter. It will be noted in this case that a large part of the detail on the ground is obscured by the haze while in the case of the one taken with the filter, this detail is clearly rendered.

In the case of very dense haze or extreme distance it may be necessary to use a red filter, Wratten No. 25 or Wratten No. 29. A film more sensitive to red light than the standard panchromatic motion picture negative is required in such cases and hypersensitized panchromatic film must be used. Standard panchromatic negative film may be hypersensitized by treating with ammonia. The film is bathed 1.5 minutes in 4 per cent ammonia at 50°F. and dried as rapidly as possible. Hypersensitized film does not keep for a very long time but can be relied upon for a week or more. The general sensitivity of the film is increased appreciably by this treatment but the green and especially the red sensitivity is increased in much greater proportion than the blue. The red sensitivity of film hypersensitized in this manner is about four times as great as the standard product. A spectrogram showing quantitatively the spectral sensitivity of hypersensitized panchromatic film is shown at *B* in Fig. 23. Even greater haze cutting can be obtained by using Eastman Panchromatic K film which is very sensitive to infrared radiation (see Fig. 23, *C*) and not at all sensitive to the green, yellow, and orange of the visible spectrum. Any filter which completely absorbs the short wave-lengths to which the film is sensitive (wave-lengths less than 500 mu) is satisfactory for use with the film. The photographs shown in Fig. 24 illustrate the haze elimination obtained by use of Panchromatic K film.

Moonlight Effects

Some years ago Prof. R. W. Wood of John Hopkins University called attention to the fact that landscapes when photographed by infrared light present very peculiar and weird appearances. This is due to the fact that the light from the sky contains no infrared radiation and hence the sky is rendered as totally black, while green foliage is rendered as white. This follows as a consequence of the peculiar spectral reflecting characteristics of green leaves containing the coloring matter known as chlorophyll. *Chlorophyll* reflects quite strongly the extreme red and infrared radiation. Hence in a photograph taken by infrared radiation green leaves are rendered as white. In a paper published in No. 22 of these Transactions (page 20) Mr. J. A. Ball suggested the use of film sensitized with Kryptocyanine for obtaining moonlight and night effects without the aid of artificial light. Film of this type is now commercially available under the name of Eastman Panchromatic K. In Fig. 23 at *C* the spectrogram given shows qualitatively the spectral sensitivity of this material. It will be noted that in addition to the usual sensitivity of ordinary film in the blue region it shows a band of high sensitivity having a maximum at wave-length 760 mu, this being in the infra-red region the eye is entirely insensitive to radiation of this wave-length. Panchromatic K film as shown by the spectrogram is insensitive to the green, yellow, and orange of the visible spectrum. In using this material for obtaining pictures by infra-red light it is only necessary to use a deep yellow or orange filter which absorbs completely the light of short wave-length to which the film is sensitive.

Night Scenes

Effects which suggest night scenes can be made by using hypersenitized panchromatic film with a deep red filter such as Wratten No. 25 or No. 29. The result is much more striking, however, and approaches the true night or moonlight effect when panchromatic K film is used with a red filter such as No. 25. The sensitivity of this material to the infrared radiation is such that under bright sunlight conditions outdoors motion pictures at standard speed can be made with a lens having an aperture of f.3.5. This applies to the most favorable conditions. In case the sunlight is not of highest intensity it may be necessary to use a lens working at f.1.9. In Fig. 25 is shown the reproduction of a photograph made on Panchromatic K film.

DEVELOPMENT OF PANCHROMATIC FILM

Dark Room Illumination

SINCE panchromatic film is almost equally sensitive to all colors, including red, the film would be fogged if handled in the dark room with the ordinary safelights. With a Wratten Series No. 2 (red)

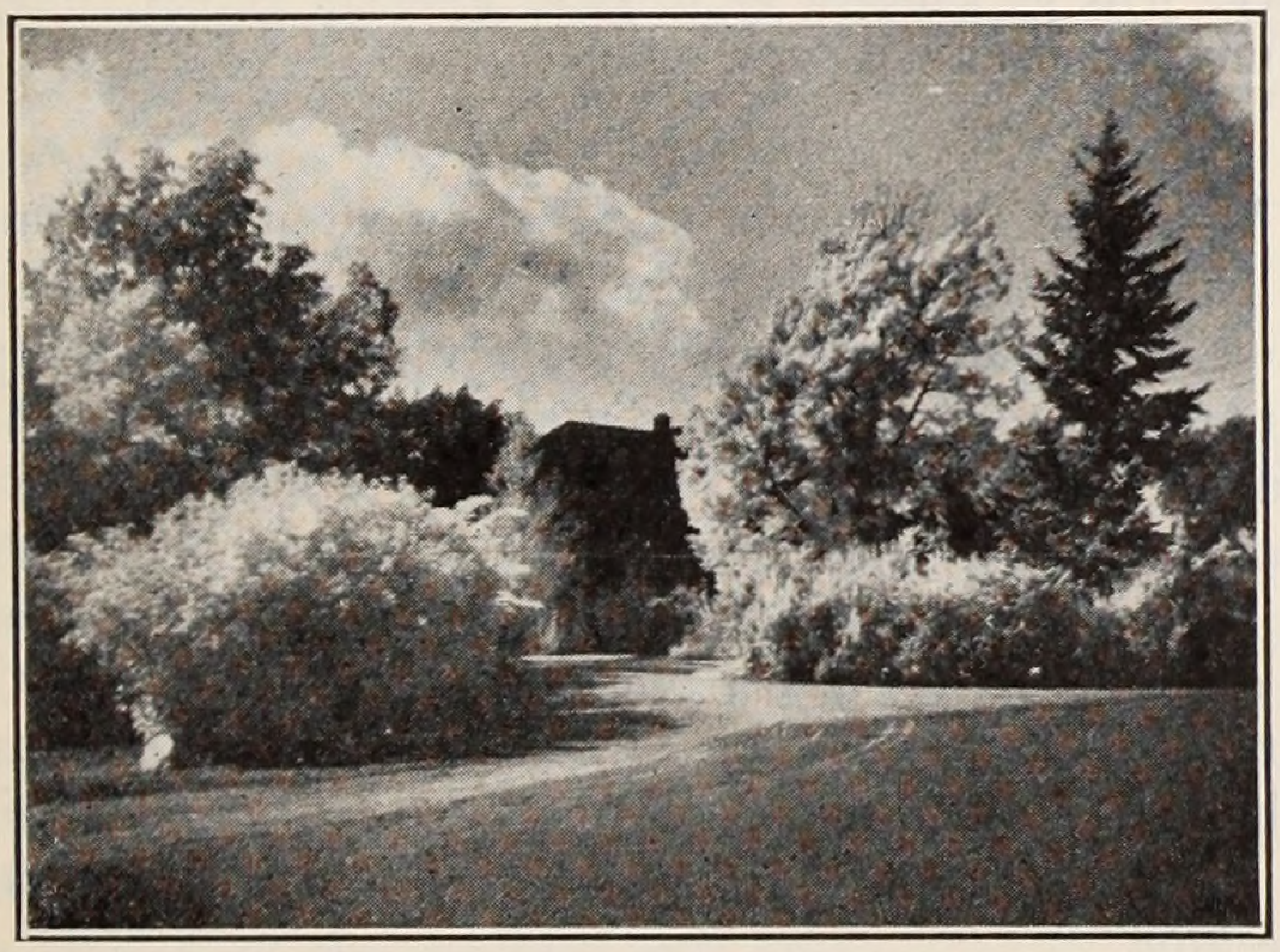

Figure 25

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8x10 safelight containing a 25 watt bulb, if film is exposed 12 inches away from this safelight for 10 seconds a fog density of 1.5 is obtained with normal development, which density is in excess of the average highlight density of a negative. With superspeed motion picture film under the same conditions after exposing for 2 minutes, only a just visible fog is produced.

In selecting safelights for panchromatic film they should be such that they transmit light to which the eye is most sensitive. For low light intensities the eye is most sensitive to light having a wavelength around 520 mu. The Wratten safelights Series Nos. 3 and 4 transmit light in this region of the spectrum, but panchromatic film will be fogged by such light if the intensity and time of exposure exceed a certain critical value. For equal visibilities the light transmitted by the Series 3 safelight has only 1/60 of the photographic effect of the Series 2 safelight.

The problem therefore, of illuminating the dark room is to utilize a minimum quantity of the light transmitted by the Series 3 Wratten safelight to the best advantage.

General Illumination

For each 100 square feet of ceiling area one 8x10 inverted safelight fitted with a 25 watt bulb and Series 3 filter adjusted 2 feet from the ceiling is satisfactory. The walls of the dark room should be painted white or cream so as to reflect as much light as possible and all conspicuous objects should be painted a light color so that they will be more readily visible. In a dark room illuminated in this manner from 10 to 15 minutes are required before the eye accommodates itself to this low intensity level; the time for accommodation depending upon the previous intensity to which the eye was subjected.

With such illumination a rack of film placed anywhere on the dark room floor will not become fogged in less than 25 minutes so that in most cases it is possible to double the wattage and therefore the brightness of the lamp in the safelight when there will still be ample margin of safety. If it is desired to double or triple the brightness of the safelights it is advisable to partition off a portion of the dark room for loading so that the film racks will be exposed as little as possible to the stronger illumination in the dark room.

Film Inspection Lights

With the rack system of development it is customary to examine the film at intervals by means of a safelight illuminator extending across the developing tank. If the illuminator is fitted with a Series 3 safelight and the intensity adjusted either by inserting tissue paper, opal glass, or ground glass between the lamp and the safelight so that the film is not fogged in less than 10 seconds at a distance of 12 inches, this will provide ample time for inspection while the visibility will be satisfactory. The lamps in question should be fitted with a foot switch so that the lamp is illuminated only while inspecting the film.

A simpler method of illuminating the film for inspection is by means of a pocket flash lamp fitted with a Series 3 safelight about 2 inches square. The intensity should be adjusted so that the film is not appreciably fogged in less than 5 seconds at a distance of 3 inches. This method of inspection has the advantage that if any fog is produced it is only local, and its use eliminates fire hazard.

Use of Desenitizers

Desensitizers have the remarkable property of more or less destroying the light sensitiveness of the unexposed portions of an exposed image while they do not interfere with the progress of development of the exposed portions. Therefore, by bathing the exposed film previous to development in a solution of the desensitizer or by incorporating the desensitizer in the developer, after development has proceeded for one or two minutes the film can be freely examined in a light of such intensity that it would otherwise be fogged. The most satisfactory desensitizer known is Pinakryptol Green, obtainable from H. A. Metz, 122 Hudson Street, New York, N. Y. For use as a preliminary bath dissolve 6 grains of Pinakryptol Green in each gallon of water (0.1 grams per liter) and immerse the film for 2 to 3 minutes before transferring to the developer. When used in the developer dissolve 2½ grains per gallon of developer (0.04 grams per liter). With some developers rich in hydroquinone it is impossible to add the desensitizer directly to the bath because it is precipitated.

After such treatment with a desensitizer, panchromatic film may be inspected with safety with a Series 4 Wratten safelight containing a 25 watt bulb at a distance of 12 inches. This gives ample illumination under all circumstances. When using desensitizers and a correspondingly brighter dark room illumination there is always danger of accidentally fogging an emulsion in the brighter light before the desensitizing solutions have had sufficient time to act. It is preferable to give a preliminary bath in the desensitizer in a separate room and then transfer the racks to the dark room proper rather than to add the desensitizer to the developer.

Processing Solutions

Any developer formula which is satisfactory for superspeed negative is suitable also for panchromatic film. For a given time of development the panchromatic film gives slightly greater contrast than the superspeed but this can be compensated for by developing for a shorter time.

[THE END]

Cinema Machine, Equipment Shop Moves *to* New Place

The L. A. Utility Air Brush Company, formerly well known in film technical circles as the L. A. Motion Picture Company, has removed to new quarters at 5811 West Adams Street, Los Angeles. For many years, the firm occupied a plant on Washington Street, near Main, at one time a pioneer film production center.

As heretofore, the company will continue to do general motion picture machine work, and deal in motion picture equipment and air brush tools, according to an announcement from A. J. Sagon, the proprietor.

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AMATEUR CINEMATOGRAPHY

(Continued from Page Four)

The stirrer is then removed and the crucible is placed on a fire-brick platform and let cool for half hour.

At the expiration of this time, the mixture is entered into the *"annealing furnace,"* where it is allowed to cool very gradually.

When taken out from the annealing furnace the glass is found broken in many pieces, large and small. Every piece is carefully examined and the defectives ones are discarded.

The chosen portion is then reheated in fire-brick moulds, in a tunnel-shaped oven until almost melting temperature.

The glass will take the shape of the moulds and it is allowed to cool for ten to twelve days in the cooling kilns.

When cool, the plates obtained are polished on both sides and carefully inspected for further defects.

If the plates fit for use amount to one-fifth of the whole melting, the result is considered satisfactory.

The glass thus selected as most perfect is then shaped by skilled workmen into lenses, whose surface curvatures have been calculated with great mathematical exactness.

(To Be Continued Next Month)

CLEANING LIQUIDS

(Continued from Page 10)

vent action on the base, while commercial trichlorethylene affects the gelatin coating and the image; these liquids are therefore unsuitable. Further tests were made with pure trichlorethylene, tetrachlorethylene, and carbon tetrachloride at 95°F. as follows:

Effect of Non-Inflammable Solvents on Motion Picture Film at 95°F.

Solvent	*Condition of Film (Nitrate Base)*
Trichlorethylene (Roessler & Hasslacher)	No effect on base. Image turned slightly brown in four days.
Tetrachlorethylene (Dow)	Image attacked at surface of liquid at end of four days.
Carbon tetrachloride (Dow)	Started to curl at end of six days. No effect on image.
Carbon tetrachloride (pure E. K. Co.)	Started to curl at end of eight days. No effect on image.
Carbon tetrachloride (taken from fire extinguisher)	Film curled at once and turned brown above liquid at end of three days.

Any effect of the above solvents on the image was attributed to decomposition in the presence of water with the liberation of hydrochloric acid. A sample of old tetrachlorethylene which was strongly acid was treated with anhydrous sodium carbonate which would remove any acid present and this sample had no effect on the image. Another acid sample was treated with anhydrous calcium chloride to remove water, but this affected the image, showing that hydrogen chloride when dissolved in the solvent and in the absence of water will attack the image. To confirm this, dry hydrogen chloride was passed into pure dry carbon tetrachloride. The resulting liquid attacked the silver image, bleaching it to white silver chloride.

The above tests indicated that of the solvents tested, carbon tetrachloride is the most resistant to decomposition by heat and moisture.

Effect of Light on Solvents

Since on storage, solvents are subjected to the action of light, the effect of exposure to light on the rate of decomposition was studied. In order to secure an accelerated effect the solvents were exposed in open bottles in the presence of moisture to a quartz mercury vapor lamp for from five to thirty hours. Strips of film were then immersed in the light-exposed solvents for varying times and any effect on the base or silver image was observed.

The acidity of the samples was also determined by adding an equal volume of water, shaking thoroughly and titrating with decinormal caustic soda. As shown by the following table, the effect on the film image was roughly proportional to the quantity of hydrochloric acid present.

Effect of Light on Solvents at 70 Degrees F.

Nature of Solvent	Time of Exp. to Mercury Vapor Lamp	Acidity (cc. N /10 NaOH)	Remarks
Trichlorethylene (Roessler & Hasslacher)	None	0.12cc.	Slight curl. No effect on image in 10 days.
Trichlorethylene (R. & H.)	5 hrs.	1.10cc.	Film badly curled. Image bleached 2 days.
Tetrachlorethylene (R. & H.)	None	0.12cc.	No effect on film in 10 days.
Tetrachlorethylene (R. & H.)	5 hrs.	0.65cc.	Image destroyed in 2 days.
Carbon tetrachloride (R. & H.)	None	0.09cc.	No effect in 10 days.
Carbon tetrachloride (R. & H.)	31 hrs.	0.09cc.	Image turned brown in 10 days.

The above results show that trichlorethylene and tetrachlorethylene under the influence of violet light and moisture undergo decomposition. The compounds are probably oxidized to phosgene ($COCl_2$) which is decomposed by moisture to form hydrochloric acid and carbon dioxide as represented by the following equations:

$$\underset{\text{Tetrachlorethylene}}{C_2Cl_4} + \underset{\text{Oxygen}}{O_2} = \underset{\text{Phosgene}}{2COCl_2}$$

$$\underset{\text{Phosgene}}{COCl_2} + \underset{\text{Water}}{H_2O} = \underset{\text{Hydrochloric acid}}{2HCl} + \underset{\text{Carbon dioxide}}{CO_2}$$

The hydrochloric acid formed attacks the gelatin, causing it to soften, and likewise converts the image to silver chloride. The extreme toxicity attributed to old or im-

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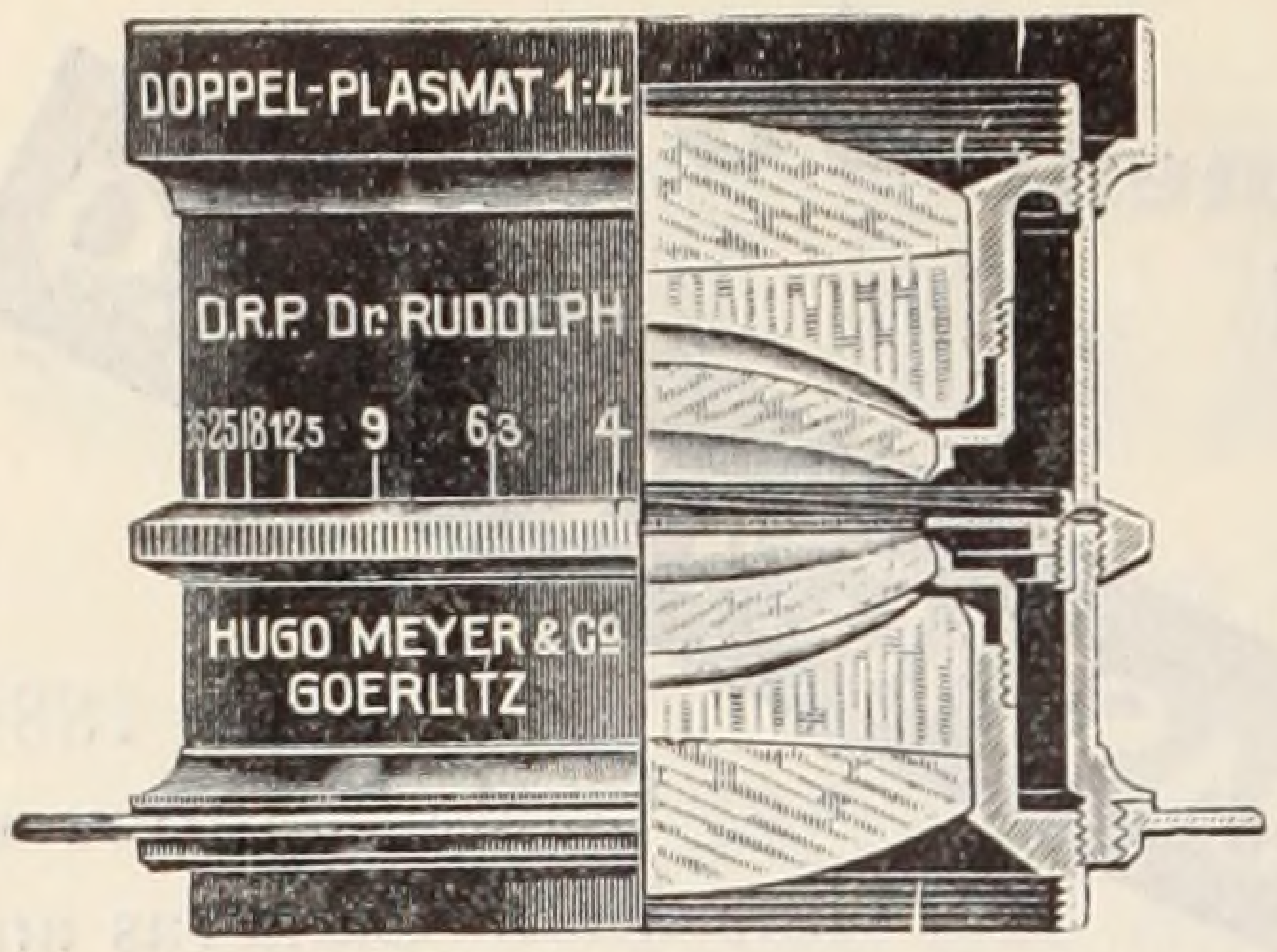

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pure samples of compounds of this type is undoubtedly due to the presence of phosgene.

Of the non-inflammable compounds tested, carbon tetrachloride most nearly approaches the ideal film cleaning liquid as outlined under the above list of requirements. It is especially valuable since when pure it does not readily decompose under the influence of light to form compounds which are injurious to the film. However, in order to prevent any possible decomposition on storage, it should be kept in brown bottles or opaque containers.

Inflammable Film-Cleaning Liquids

In addition to non-inflammable solvents, a survey of possible inflammable liquids was also made because it was considered that in the event that an otherwise suitable liquid in this classification was discovered, its objectionable inflammability might be partly overcome by admixture with carbon tetrachloride.

The only promising solvents under this classification were benzene, toluene, xylene, gasoline and allied petroleum distillation products. Tests with these compounds, similar to those made with the non-inflammable compounds above, showed that none of the solvents affected the silver image, but benzene and toluene caused film with nitrate and acetate base to curl after immersion for two days at 70°F. All these solvents evaporate more slowly than carbon tetrachloride, which in some cases may be desirable.

It was considered that possibly these compounds might be considerably less toxic than carbon tetrachloride, in which case it would be desirable to remove danger of explosion.

Toxicity of Benzene, Gasoline and Carbon Tetrachloride

Although no practical toxicity tests were made with the solvents under investigation, adequate information is to be found in the literature. Tests with animals have shown that benzene, gasoline and halogen substitution products of the hydrocarbons such as carbon tetrachloride all produce varying stages of poisoning, resulting in dizziness and unconsciousness, and finally death.

Lehmann[3] found that with cats, air containing 20 to 30 mg. per liter of benzene causes loss of consciousness in a few hours and 42 mg. per liter produced death. Hamilton[4] quotes a large number of cases of benzene poisoning in industry, some of which resulted in death.

Haggard[5] experimented with dogs and found that the toxicity of gasoline was about one-half that of benzene.

Lehmann,[6] working with rabbits, found that 240 mg. per liter of carbon tetrachloride were necessary to produce death in two hours. Although no data were found giving a direct comparison between the toxicity of carbon tetrachloride, benzene and gasoline, a survey of the experiments of Haggard and Lehmann indicates that carbon tetrachloride is less toxic than benzene and slightly more toxic than gasoline, though this depends on its purity. Few cases of industrial poisoning by carbon tetrachloride have been recorded and these deaths were probably due to the use of an impure product which may have contained an excess of phosgene and hydrogen chloride.

Since the presence of 3 to 5 mg. per liter of carbon tetrachloride imparts a strong odor to the air, there is no excuse in practice for the concentration approaching the danger point, which is 10 times this concentration.

The Suitability of Carbon Tetrachloride for Cleaning Motion Picture Film

The above experiments indicate that carbon tetrachloride when pure is quite satisfactory for cleaning motion picture film. It is a good solvent for oils and fats, evaporates readily, is non-combustible and is readily available at a reasonable price. It does not affect the image even on prolonged contact and has a minimum tendency to decompose on exposure to light in the presence of moisture. Although toxic when impure, the pure compound is no more toxic than benzene and if reasonable ventilation is provided, it may be used with relative safety.

Tests also showed that carbon tetrachloride has no curling effect on film with nitrate or safety base after two days and it does not remove the color from either nitrate or safety film with tinted base.

Manufacturers such as the Dow Chemical Co. and the Eastman Kokak Co. supply sulphur-free carbon tetrachloride which is satisfactory for cleaning film. A few years ago many commercial samples of tetrachloride contained sulphur which was formed as a by-product in its manufacture by the action of chlorine on carbon disulphide. On exposure to the aid in the presence of moisture sulphur chloride deposits sulphur which is capable of combining with the silver image to form yellow silver sulphide. Such samples of carbon tetrachloride containing sulphur chloride when left in contact with motion picture film attacks the image, especially in the presence of moisture, and bleached it out to a faint yellowish-white image of silver sulphide. No such commercially impure samples of carbon tetrachloride have been encountered within the past two years.

Mixtures of Carbon Tetrachloride with Inflammable Solvents

In some laboratories and exchanges a mixture of carbon tetrachloride with high-test gasoline is used for film cleaning. This mixture evaporates less readily than pure tetrachloride, which may be an advantage in some cases. Its adoption in the past was a result of the toxicity of impure samples of tetrachloride, a 50 per cent mixture by volume with gasoline reducing this considerably. This mixture burns with great difficulty and is satisfactory from a fire hazard standpoint, although the proportion of the two liquids necessary to give a non-inflammable mixture depends on the nature of the gasoline. It is considered that pure carbon tetrachloride is to be preferred to such a mixture for general purposes.

Film Moistening Liquids

In addition to accumulating oil during projection, both the film base and gelatin coating lose moisture and tend to become brittle, owing to the excessive heat to which the film is subjected. If the film were allowed to cool to room temperature between successive projections, little trouble would be encountered, but in practice the film does not cool off sufficiently between successive projections and the resulting baking process drives out the moisture, which results in brittleness.

If film which has been rendered brittle in this manner is exposed to a moist atmosphere even for only a relatively short time it tends to regain its flexibility. It is not possible to do this by placing the tightly wound reels of film in a humidor or a vessel containing water because the moisture penetrates the convolutions of film very slowly. It would be possible to humidify the film satisfactorily by passing it continuously through a humid chamber or by winding the film in contact with a damp strip of paper or other absorbent ribbon. Such a system, however, is inconvenient in the theatre or exchange.

A satisfactory method of moistening film is to immerse it in a mixture of water and a water miscible volatile liquid such as grain alcohol. The percentage of water to be used in the mixture depends on the degree of brittleness of the film and the time which elapses betwen application and vaporation of the liquid. If an application machine of the Dworsky[2] type is used, this depends on the rate of passage of the film through the machine. During this short period little or no swelling of the gelatin coating occurs, but sufficient moisture is absorbed to restore the flexibility of the dried out gelatin coating. Moreover, when the film is wound up in a roll, the dried out film base can also absorb moisture by virtue of being in contact with the moistened emulsion. Film base absorbs moisture relatively slowly so that little or none is absorbed by it in the period of application of the moistening liquid.

At the outset a survey was made of possible water-miscible volatile liquids which could be used for the purpose. The requirements of such a liquid are identical with those for the film base cleaning liquid outlined on page 2. A choice of the following liquids is possible: Grain alcohol, denatured alcohol, isopropyl alcohol, and tertiary butyl alcohol.

The exact quantity of water to be added to the alcohol must be determined by trial. From 15 to 25 per cent water is usually satisfactory and this proportion holds in the case of all the alcohols named above. The condition of the film after treatment will indicate any necessary changes in the proportion of water to be added. If it is too tacky, less water should be used and if too dry and brittle the quantity should be increased.

A mixture of either of the above alcohols with water has little or no solvent action on mineral oil which may be present in film after projection. However, in practice the rubber squeegees in the Dworsky[1] machine tend to emulsify and remove traces of oil. If much oil and dirt is present on the film a moistening liquid which is also capable of dissolving oil must be used.

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1. H. C. Fuller, Chem. and Met. Eng. **29**, 538, 1923.
2. Faulkner, Trans, S. W. P. E. **25**, 117, 1926.
3. K. B. Lehmann, Arch. fur Hyg. **75**, 1, 1912.
4. "Industrial Poisoning in the U. S.,, by A. Hamilton (MacMillan.)
5. Haggard, J. Pharmacol and Exp. Theraup. **16**, 401, 1920.
6. H. B. Lehmann, Arch. fur Hyg. **24**, 1, 1911.

(To be continued next month)

PROJECTION—Conducted by Earl J. Denison

Experimenting by Projectionists

By Daniel B. Clark, A.S.C.

President of A.S.C. Commends Move to Experiment With and Solve Problems of Projection

WORD comes from the east that one of the projectionists' locals has set up an experimental department in which their members may make tests concerning their calling.

Final Test

If the experiences of the cinematographers are criterion, this step of the projectionists should prove greatly progressive. As perfect as projection equipment is, its ultimate test is how it performs under actual working conditions, and it is the projectionist who presides over the apparatus while it is in operation. It is he who can best report just what its good points are, and wherein improvement, if any, can best be introduced.

For Own Use

If the projectionist is anything like the cinematographer, ideas for the improvement of his "tools" are bound to occur to him as he becomes more and more immersed in his work. It may be that these inspirations can only be applied to his own particular projection conditions, and certainly he should have the opportunity to work his theories out.

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Here is where organized effort comes in. Cinematography has advanced by leaps and bounds because cinematographers have found ways and means to carry out their creative thoughts and put them into effect.

If the projectionists throughout the country can do the same thing, their profession should likewise benefit. It is not necessary to have some radical device in mind before an experimental laboratory can prove of value; even the most everyday duties can be improved on if an organization of men give them their concerted attention and exchange ideas concerning them.

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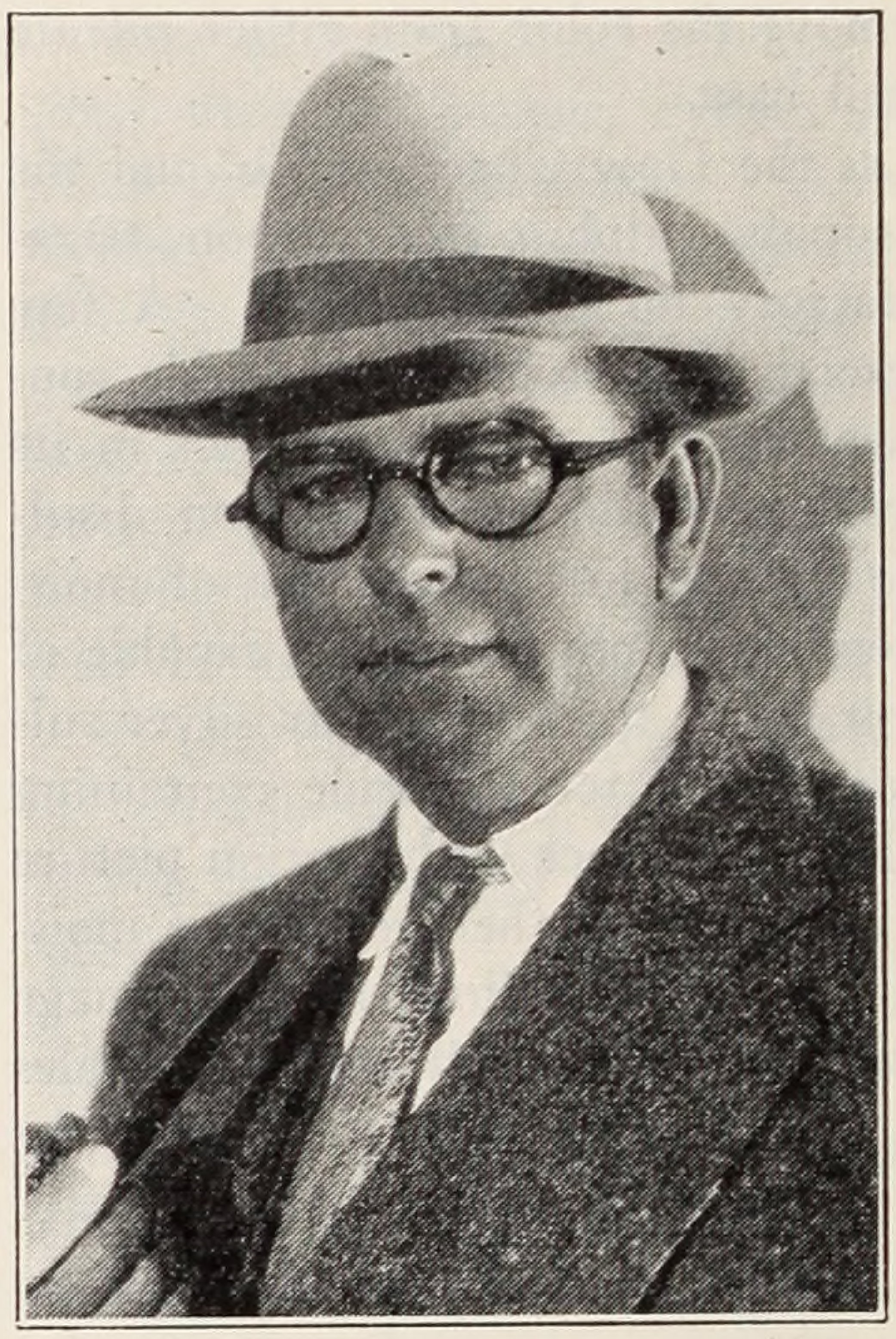

Ira H. Morgan, A.S.C., who is receiving the praises of critics of cinematography for his work in Metro-Goldwyn-Mayer's "Tell It to the Marines," on which Morgan was chief cinematographer.

The A.S.C. member is one of the aces on the camera staff at the Culver City studio where he has been holding forth for the past several seasons. Morgan served as chief cinematographer on many of Marion Davies' best remembered productions, including "When Knighthood Was in Flower."

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Warrenton, Gilbert—with Universal.
Wenstrom, Harold—
Whitman, Philip H.—with Scenario Dept., Mack Sennett Studios.
Wilky, L. Guy—

Zucker, Frank C.—Robt. Kane Prod., Cosmopolitan Studios, New York City.

Eastman George—Honorary Member.
Edison, Thomas A.—Honorary Member.
Webb, Arthur C.—Attorney

Meetings of the American Society of Cinematographers are held as called on Monday evenings in the A. S. C. assembly rooms—

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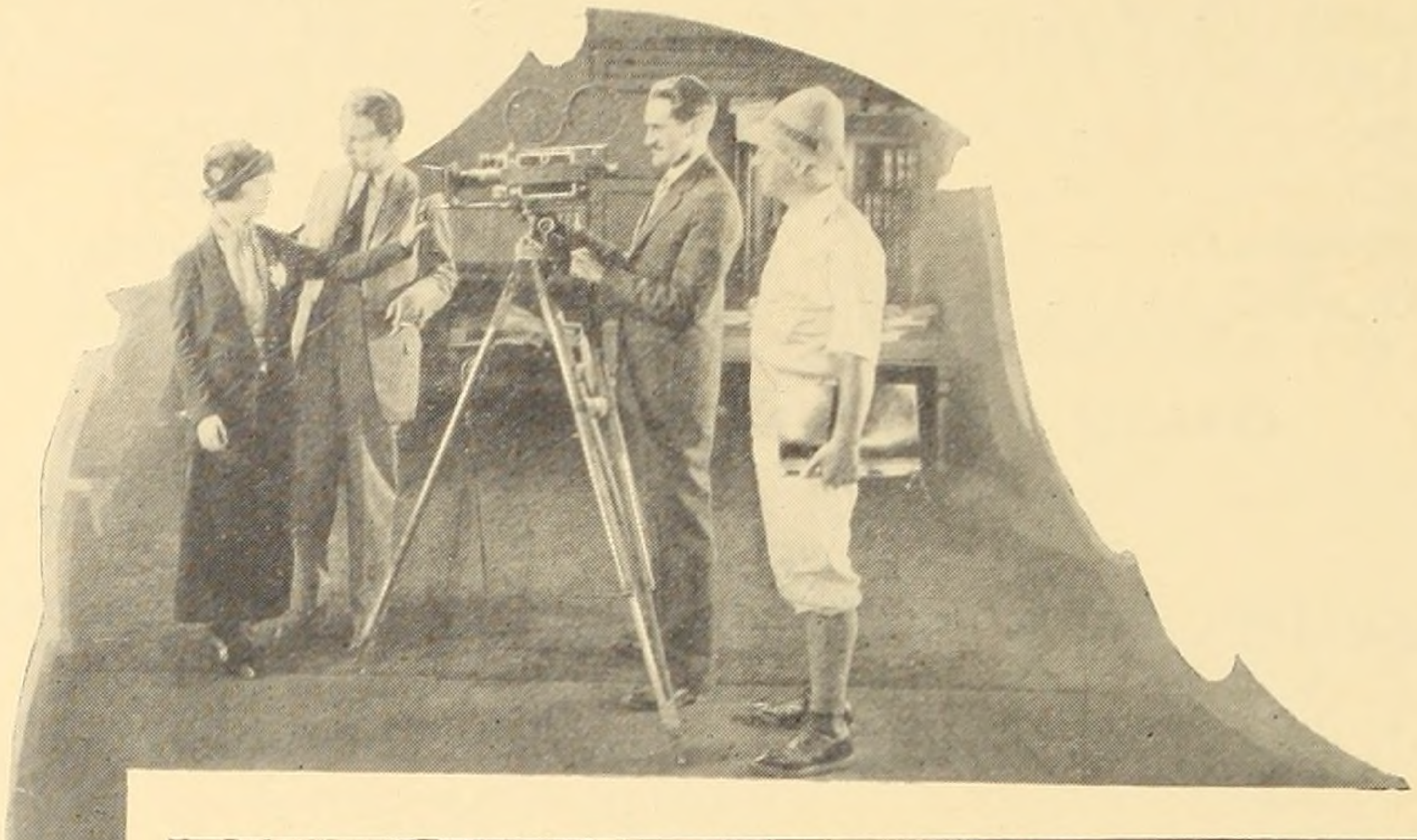

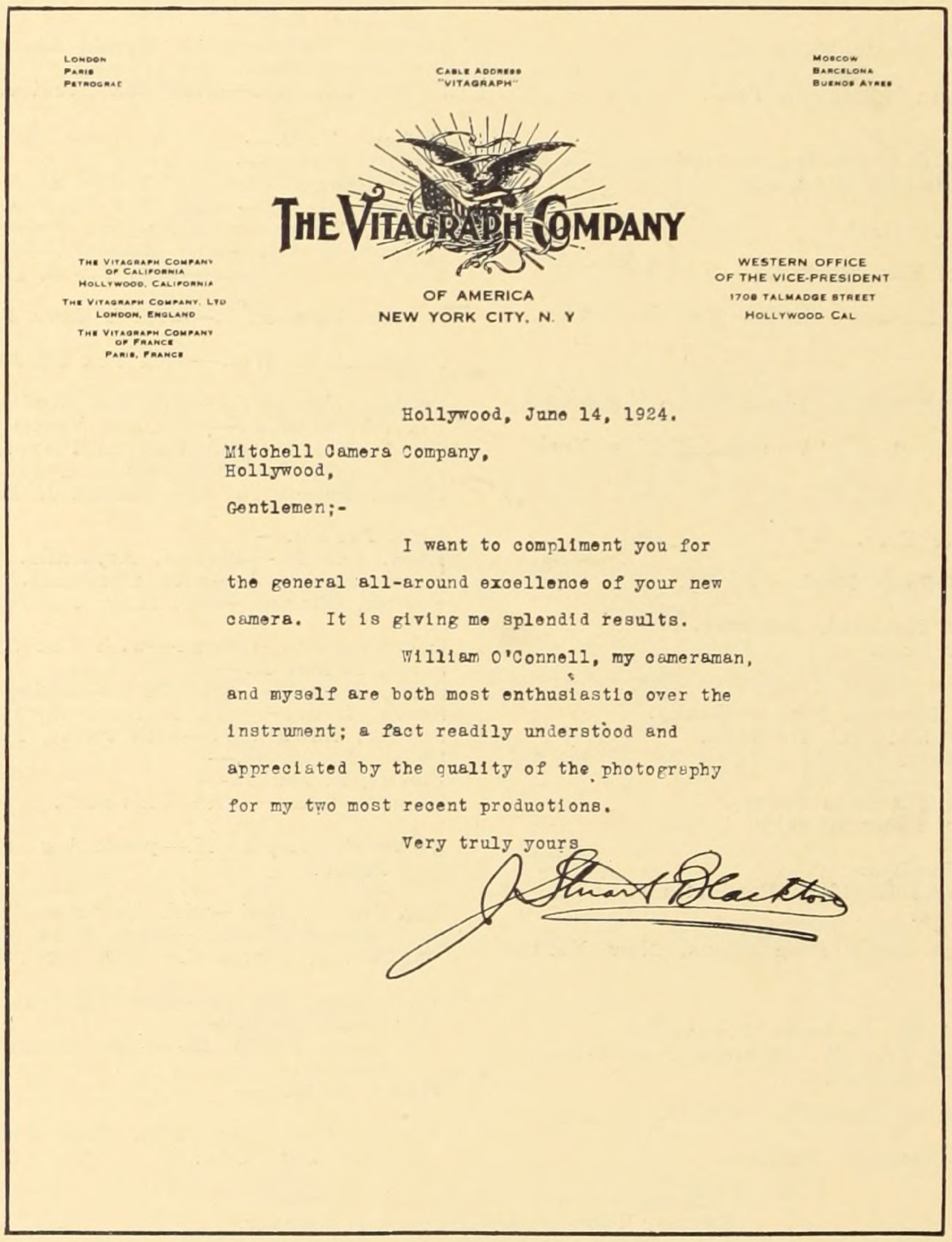

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Hollywood, June 14, 1924.

Mitchell Camera Company,
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Gentlemen;-

I want to compliment you for the general all-around excellence of your new camera. It is giving me splendid results.

William O'Connell, my cameraman, and myself are both most enthusiastic over the instrument; a fact readily understood and appreciated by the quality of the photography for my two most recent productions.

Very truly yours

J. Stuart Blackton